# Electrical World

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**Commission Order Rescinded**

The Missouri Public Service Commission has rescinded its order directing a company under its jurisdiction to remove the manager from office. It is doubtful whether the commission had the power it thought it had when it passed its remarkable order directing the company to remove its manager. However, that is not so important now as is the fact that the commission, realizing its mistake, had the good sense and courage to admit it and, so far as it could, to correct it. In administering any regulative law a commission is imposing a new state of affairs upon managers of public utility corporations. If a commission is right in its conception of the law and a manager of a corporation is wrong, the commission is not justified in treating him in any other spirit than one of tolerance and co-operation. If a commission is wrong and a manager is right, there is all the more reason why the commission should want to have a spirit of co-operation in itself and to secure such a spirit in return from the manager. The law imposes regulation, it does not impose management by the commission. It is just as necessary for the commission to have the respect of officials of public utility corporations as it is for the officials of public utility corporations to have the respect of the commission. Antagonism on either side is unfortunate and wherever it arises every effort should be made to harmonize the differences that are responsible for it. If differences develop for which the corporation is responsible and careful consideration shows that an error was made, the best thing to do is to adopt the manly method followed by the Missouri commission in this case. Admission and rectification promote good feeling.

**Careless Station Wiring**

In many small central-station systems home-made auxiliary equipment is in use with automatic or semi-automatic service rendered to municipal pumping installations or other consumers of an intermittent or non-continuous energy input. A broad field of usefulness exists for such apparatus and for all kinds of "stunts" associated with alarms for low water and high water, abnormal variations in temperature at important points in the steam end of the station, the height of oil in lubrication systems, undue changes in frequency, and the like. In fact, there is hardly a limit to the conveniences with which a small plant may be equipped, given an ingenious manager or superintendent eager to apply his experimental skill to saving labor and time in operation. In too many cases, however, the wiring employed in work of this kind is installed without the slightest regard for mechanical fitness and with the most indifferent concern for electrical hazards. These circuits are almost invariably "slapped into place" with as little thought of danger as would be given to a buzzer circuit in an old ladies' home. Good mechanical work and first-class electrical insulation are really of great importance in temporary wiring of this sort, for serious injury to persons or property may follow a cross with higher voltage leads. Anything but first-class construction tends to introduce into the service an element which lacks reliability. Unless, therefore, the best standards are followed, the operating results may be worse than would be the case had no conveniences been installed in the first place.

**Transmission Line Innovations**

The account in this issue of the lines and substations distributing energy from the Tallulah Falls is one which should be thoroughly studied by every engineer interested in energy transmission. We have already commented on the hydraulic features of the plant, some of which are striking and unusual. The transmission system is equally a step along the highway of progress toward simplification. The main 90-mile line operated at 110,000 volts from the station of Atlanta is typical of the other circuits. It is rather noticeable for the height of the towers and the great spans between them. The average distances between towers is a little over 900 ft., and the towers themselves range from 66 ft. to as much as 105 ft. in height. There are two complete circuits, one on each side of the tower, with 9-ft. spacing between the wires. More striking, however, than the method followed in tower construction are the substation work and provisions for cross-overs between the circuits. The fundamental principle which has been followed in this part of the work is to make the high-tension switching structure part of the transmission line instead of part of the interior equipment of the substation. The switch apparatus is for the most part in the open air, and the system is so devised that the major part of all switching and transference work is done by simple open-air switches of ample size. Oil switches are used, so to speak, only in the second line of defence, for the reason that most of the work does not involve opening circuits under heavy load. When as a final resort this becomes necessary means are at hand to accomplish it, but the ordinary operations of the transmission system can be carried out on the open-air system conveniently and safely without involving the huge expense which would be entailed by a battery of oil switches sufficient to accomplish all the combinations, for the most of which they are entirely unnecessary. Similarly, substation transformers are placed out of doors, whenever convenient, on the same general theory that impels one to place transformers of lower volt-

age on poles instead of in special houses. As transmission voltages have grown higher fear of them has diminished and a great many provisions once thought necessary are now seen to be the result of over-caution. A switching system on a transmission line has certain perfectly definite work to do, and when the apparatus is fitted to do this work the ends of operative security have been met. It is unnecessary and a needless expense to provide for ringing all the possible changes upon combinations of a certain number of conductors when it is perfectly evident from the outset that only a quarter of these combinations have any operative significance. The details of these out-of-door stations are very fully given in the article, and we commend them to the attention of our readers as indicating a most instructive tendency in the progress of transmission work.

## The Electrification of Trunk Lines

In many respects the presentation and discussion of the paper by Mr. A. H. Armstrong before the Canadian Society of Civil Engineers, abstracted in this issue, are of more than passing interest and importance. In accordance with a practice which has become chronic in railway electrical engineering circles, there was displayed, perhaps as never before, the disposition to dodge the main issues and to set up imposing figures of straw for the purpose of knocking them down. It strongly calls to mind the frontier days more than a score of years back when the advocates of direct current and of alternating current for lighting were taking pot shots at each other out of the darkness and carrying knives in their boots on the few occasions when they met on a common ground of apparent amicability. These days have happily passed so far as the lighting problems are concerned, but the continuance of the old blood-feud by the second generation, which is working upon traction problems, is one of the most serious difficulties standing in the way of railway electrification. It is time for a much more open discussion of the whole situation than has yet appeared if substantial progress is to be made in the near future.

What can the ordinary railway manager think of the probability of successful electrification when he reads a paper like that before us and the discussion to which it gave rise? The author claims in the strongest terms that electrification by alternating current is to all intents and purposes impracticable, and in the discussion it was pointed out with the utmost plainness that there has never been a typical trunk-line electrification up to the present time carried out successfully by direct current. The impartial railway manager, assuming that the statements on both sides are sincere and soundly based, must necessarily come to the conclusion that neither system can in the present state of development be seriously considered, and he is quite justified if he simply says inwardly or outwardly, "A plague on both your houses," and sticks to his steam locomotives. The trouble with all such discussions, and pre-eminently with this one, is that the argument depends either on actual installations which cannot by the widest stretch of imagination be considered typical or on hypothetical installations for which the conditions set are ingeniously devised to throw down one or the other of the systems discussed.

The fact of the matter is that the data available for a fair comparison between the direct-current and the alternating-current system are highly unsatisfactory as yet, but that both systems have been successful when used within their own proper spheres. The New Haven electrification certainly cannot be considered in any sense a failure in spite of somewhat costly experience during the experimental period and the very severe handicap of having to furnish locomotives able to run with equal facility on alternating current and direct current. Similarly, any fair-minded person must grant that the New York Central and the Pennsylvania terminal equipments, within their limitations, have made excellent records; but these are strictly terminal lines not subject to the difficulties of distribution and current collection which would inevitably be met on a trunk line.

We do not desire here to discuss the details of the somewhat hypothetical comparisons in the paper before us. These can properly be left to the advocates of the competing systems to discuss among themselves. What we do desire most emphatically to point out is that the art cannot make progress by the mutual abuse of competitors, and that it is high time for the advocates of both systems to brush the dust and blood out of their eyes, to forget the ancient rancor, long past in other branches of electrical engineering, and to stand together in an effort to see clearly along the line which, up to the present, has been blocked by the débris of battle rather than by genuine obstacles.

## Disconnecting Switches

Considering its value as a preventive of serious accidents, the disconnecting switch is one of the features of a generating plant or substation handling high-voltage alternating current that should not be subjected to the blue pencil of the appropriation censor. The cost of installing such switches on both sides of every high-tension oil circuit-breaker is ordinarily a small matter per switch. In substations requiring wide spacing between conductors on account of the use of extra high voltages, the increased safety gained by providing this absolutely effective protection between buses, oil switches and transformers, lightning-arrester grounds, and even buses, should be well worth the expense. The mechanical support of every additional structure in a high-tension station doubtless increases the complications of the interior, but the actual space requirements of disconnecting switches are intrinsically small, and if a full complement is planned for in the original design they should not be omitted. The flexibility of station operation can be very greatly enhanced in some cases by the use of disconnecting switches in bus sectionalization, although they are not designed to be opened, of course, while there is a load interchange between the sides to be isolated. Under some conditions it may pay to render one side of a station inactive pending the temporary opening of such switches, to be followed by synchronizing the temporarily interrupted units and proceeding independently of trouble on the opposite side of the station. In other words, if a plant is too small to justify the installation of a bus-junction oil circuit-breaker, it still may have use for the humble disconnector.

## Exit Government Ownership, Enter Government Settlement

The irritation to business conditions caused by the Postmaster-General's personally conducted movement for federal ownership of telegraph and telephone lines was succeeded quickly by satisfaction when the friendly settlement of the government suit against the American Telephone & Telegraph Company under the Sherman law was announced. The menace of government ownership and the spirit in which President Wilson indorsed the end of the litigation against the company are as far apart as the antipodes, and business men appraised them accordingly. One was a disturbing factor, the other a reassuring one. There has been too much to disturb business, too little to reassure it. If the government pendulum will but swing the other way for awhile, it will give industry an impetus that it sorely needs. Government ownership of telegraph and telephone lines would involve an enlargement of federal activities for which there is no strong public demand. In the absence of a strong public demand, a Cabinet officer and a congressman urge the complete reversal of national policies that this step would mean. Fortunately, they do not appear to speak authoritatively for the administration. The government should not undertake things that can be done as well or better by private agencies. It should not undertake things that can be done at the same or less cost by private agencies. Its function is not to suppress or supplant private initiative. It should promote private enterprise. The American people do not want a paternal government. They want freedom of individual action.

The government has not yet attained that measure of efficiency and economy which warrant its seizure of functions now well performed by private capital. The report of even the Postmaster-General, the chief exponent of the extraordinary movement for government assumption, is open to analysis and question. He says, for instance, that the postal service for the first time since 1883 is now self-supporting. Would it have been self-supporting if it had paid the unhappy railways what it ought to have paid them for carrying the enormous additional amount of mail created by the parcel post? This leads inevitably to the question of whether, in the event of government ownership of telegraph or telephone lines, there would still be a confusion in accounts to cause distorted conclusions. Would the telephone and telegraph lines, if profitable under government ownership, be required to apply their profit to offset deficits in other lines of government activity? Or if they should be unprofitable would the railways be asked to carry a still heavier burden of mail unpaid for in order that the government accounts might pass cursory inspection? Government bureaucracy and red tape are the distress of individual business men who have to go to Washington occasionally. They would cause greater and every-day distress to the whole nation if applied to the necessary telephone. Government ownership in European countries is attended by a poverty of telephone development and service which would paralyze industry here.

Instead of exploited government ownership plans, however, it is good to record that the last word from Washington settles the suit against the American Telephone & Telegraph Company and comforts business men. In separating itself from the Western Union Telegraph Company and introducing other changes the Bell company satisfies the Attorney-General that no infraction of the law is involved in its practices. The settlement is great cause for congratulation. It means much more than the fact that long, bitter, costly litigation for one large company is avoided.

The independent telephone systems are heartily to be congratulated on having such a network thrown open to them for long-distance service. If there is anything in the common carrier law, they have always been entitled to this, and they should now make the most of it. But we can imagine that in some bosoms there will be a chill of desperate discouragement in the news that the Bell system will "never hereafter acquire control over any other competitive line or exchange." What were some of them built for? The Western Union system has been admittedly all the better for its control by the Bell system, which might perhaps eventually by its ownership have enjoyed revenge for the long period during which it paid out 20 per cent of its gross earnings to the Western Union because the latter kept out of the telephone field. At any rate, by this disjunction there will be secured full justice to the Postal Telegraph Company or any other system.

The settlement looks like a pledge of the earnest intent of the government, in the words of President Wilson, to cooperate with business men and "help to build up the business of the country upon sound and permanent lines." If the application of the administration's policies to the telephone situation is partly destructive of the present system, it is still constructive of a policy which is outspokenly acceptable to the constituted government authorities. Certainly the telephone company gains much more than it loses. Ownership of telegraph facilities could never be worth as much to it as a virtual license from the government authorizing it to go ahead in a well-defined course. It can work out its progress on approved lines of development more surely than it could on lines about whose perfect legality the government's attitude cast a doubt. Moreover, its credit is safeguarded. The chief cause for congratulation over the outcome, however, is that the business atmosphere is made a little clearer for everybody. If the telephone company has ranked as a trust in the popular mind, it has ranked as a good one and its acceptance of the government policies so stamps it. Clearly its leaders see that the administration at Washington must be lived with for the period of its tenure of office. They help both themselves and the general business situation by conforming their practices to the theory of the Sherman law now guiding the policy of the government. Such a step may not be taken by other companies whose present practices are regarded by the authorities as infractions of the law. Some cases will probably go to the final courts for decision. The settlement of one, however, affords ground for reasonable belief that its general lines may be applied in other cases. Every such dispute that is removed helps to restore the conditions of wholesome business. It is this that we need, and every business interest should speed the day of its return.

# The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

## Denial of Right to Fix Resale Prices

The United States Circuit Court of Appeals in a decision filed on Dec. 19 affirmed the decision of Judge Ray in the case of Charles A. Keene versus the Waltham Watch Company regarding the right to fix a resale price on watches embodying patented movements or parts. Judge Ray had held that such refixing of prices on patented goods was in violation of the Sherman act and not defensible under the patent law.

The Circuit Court of Appeals merely confirmed the decision of Judge Ray without an opinion.

## Long Acre Company Wins

The Court of Appeals of New York in a decision handed down on Dec. 19 affirmed the decision of the Appellate Division of the Supreme Court in the case of the Long Acre Electric Light & Power Company of New York versus the New York Edison Company, thereby permitting the former to proceed with its issues of stock and bonds and with plans for the development of its plant. The New York Edison Company had appealed from an order of the Appellate Division, First Department, dismissing a writ of certiorari and affirming an order of the Public Service Commission that authorized the Long Acre company to construct a plant and issue securities. The commission originally denied that application of the Long Acre company to issue securities for the construction of its plant. A long legal battle ensued, and finally the court upheld the commission by deciding that the company could not issue securities to construct its plant until the commissioners granted permission. Later the right to construct a plant was granted by the commission, and then the Edison company brought suit in an effort to annul the action of the commission.

## Conservation Conference in Albany

Governor Glynn of New York called a conference in Albany on Dec. 22 to discuss proposed legislation on conservation, which will be introduced at the coming session of the Legislature. Most of those who appeared talked in favor of fish and game conservation. Mr. George V. S. Williams, member of the New York Public Service Commission, First District, and Mr. Charles Harvey Jackson, who was formerly connected with the State Conservation Commission, urged that the State begin at once the experimental development of hydroelectric power from waste waters by utilization of the surplus barge canal waters in Saratoga County. Mr. Williams suggested the development of water-power under a plan similar to that followed in the financing of subways in New York, involving public investment and private operation. Mr. E. J. Mehren, editor of the *Engineering Record,* declared that the State had established Public Service Commissions to supervise the issue of securities of lighting and power companies and to regulate their rates, and inferentially had promised to preserve their properties. He thought that if the State built storage reservoirs it should lease the electric power to the existing corporations, as they would be subject to regulation by commissions.

## Electricity in Coal Mining

Mr. Francis S. Peabody, president of the Peabody Coal Company, of Chicago, and one of the prominent coal-mining operators of Illinois, gave an interesting address on "Coal" before the Commonwealth Edison Section of the National Electric Light Association on Dec. 16. His address was illustrated by lantern-slide and motion pictures, some of the latter being particularly interesting from the fact that they were taken underground in coal mines. Mr. Peabody described the new mine of his company at Nokomis, Ill. This is said to be the largest coal-mining plant in the world. It has an output of 8000 tons of coal in eight hours and is operated throughout by electrical energy purchased from the Central Illinois Public Service Company.

## Convention of Wisconsin Electrical Association

The annual convention of the Wisconsin Electrical Association will be held at Milwaukee Jan. 15 and 16. Among the papers to be presented are the following: "High-Efficiency Incandescent Lamps and Their Central-Station Applications," Mr. S. E. Doane, chief engineer National Lamp Association, Cleveland, Ohio; "Some Problems of Public-Utility Accounting and Rate-Making," Mr. Halford Erickson, Wisconsin Railroad Commission, Madison; "Street-Railway Traffic Surveys in Relation to Railway Operation, Management and Regulation," Mr. C. M. Larson, chief engineer Wisconsin Railroad Commission, Madison; "A Practical Accounting System for Small Central Stations," Mr. H. G. D. Nutting, Clement C. Smith Company, Milwaukee; "Voltage Regulation, Its Necessity and How Accomplished," Mr. G. G. Post, electrical engineer the Milwaukee Electric Railway & Light Company; "Review of New Laws Affecting Public Utilities," Mr. John B. Sanborn, Milwaukee. Mr. W. H. Winslow, Superior, Wis., is president of the Wisconsin association, and Mr. George Allison, Stephenson Building, Milwaukee, is secretary.

## Going Value as Basis for Computing Charges

The United States Circuit Court for the District of Arizona recently handed down its decision in the case of the stockholders of the Pacific Gas & Electric Company of Phoenix, Ariz., for a preliminary injunction to restrain the enforcement of certain gas and electric rates prescribed by the corporation commission of the State of Arizona. The injunction was granted on the basis that the commission erred in the depreciation charged against the reproduction value of the property to ascertain the present value. The court stated that a property that was at present in an efficient operating condition could not possibly have depreciated by 49 per cent of its original value, that the commission erred in allowing $23,000 for working capital, that $50,000 for such purposes was entirely reasonable, and that the commission erred in not allowing the company a value for its contract with the reclamation service for the furnishing of electricity, an item which the commission omitted in its valuation. The court also held that the commission erred in not allowing the company some going concern value, and in commenting upon this

feature Judge Morrow said: "The courts recognize a difference in the value of a plant that has been fully established and connected up with a municipal lighting system and with the houses, business places and factories of regular customers. The present corporation was in August of last year a going concern; it was connected up with a municipal lighting system, the houses, business places, factories and other institutions of a prosperous community, and there was nothing more to do except to deliver the service for which the corporation was fully and efficiently equipped. We think this element of valuation should be considered in connection with the other elements of valuation, with the view of determining the actual present value of the whole plant."

## President Wilson on Effect of Currency Bill

In signing the currency bill on Dec. 23 President Wilson made an address in which he said in part:

"As for the bill itself, I feel that we can say that it is the first of a series of constructive measures by which the Democratic party will show that it knows how to serve the country.

"I myself have always felt, when the Democratic party was criticised as not knowing how to serve the business interests of the country, that there was no use of replying to that in words. The only satisfactory reply was in action. We have written the first chapter of that reply.

"What we are proceeding to do now is to organize our peace, is to make our prosperity not only stable but free to have an unimpeded momentum.

"It is so obvious that it should not need to be stated that nothing can be good for the country which is not good for all of the country. Nothing can be for the interest of the country which is not in the interest of everybody; therefore, the day of accommodation and of concession and of common understanding is the day of peace and achievement of necessity.

"We have come to the beginning of that day. Men are no longer resisting the conclusions which the nation has arrived at as to the necessity of readjustment of its business. Business men of all sorts are showing their willingness to come into this arrangement, which I venture to characterize as the constitution of peace. So that, by common counsel and by the accumulating force of co-operation, we are going to seek more and more to serve the country."

## Missouri Commission Reconsiders Decision Removing Manager

The Public Service Commission of Missouri has passed an order rescinding its previous decision directing the Fort Scott & Nevada Light, Heat, Water & Power Company to remove its manager at Nevada, Mo. The amendatory decision, as written by Mr. Kennish and concurred in by all of the members except Chairman Atkinson, expresses the opinion that the conduct of the manager in his business relations with the people of Nevada, who were customers of the water company, was arbitrary. However, a more thorough consideration of the case upon the motion for rehearing caused Mr. Kennish to doubt the soundness of that part of the opinion requiring the removal of the manager, and he thought that it should be modified in that respect.

Mr. Kennish, continuing, said that the fact should not be overlooked that the offending as shown by the testimony was not the result of bad faith or dishonesty but rather of bad judgment and a failure to understand the character and spirit of the people with whom the company dealt. The decision concludes:

"It is shown by the testimony that the greater part of this property is owned or controlled by Mr. Weiss, and to remove him from its management for the misconduct proved and without an opportunity to make amends is, in my opinion, an unduly harsh exercise of the power of this commission, and the order should be modified by omitting therefrom that part directing his removal."

## Direct-Current Traction for Chicago, Milwaukee & St. Paul

Mr. C. A. Goodnow, vice-president Chicago, Milwaukee & St. Paul Railroad, who is in charge of the proposed electrification of the railroad between Avery, Idaho, and Harlowton, Mont., a distance of 440 miles, informed a representative of the *Electrical World* on Tuesday that it had been decided to use 2400-volt direct current and overhead construction. The installation will be substantially the same as that of the Butte, Anaconda & Pacific. Mr. Goodnow also stated that no contract has been awarded for the apparatus and that it will go to the most satisfactory bidder.

## International Electrical Congress at San Francisco

Attention is drawn to the distinction between the International Electrical Congress to be held at San Francisco, Sept. 13 to 18, 1915, during the Panama-Pacific International Exposition, as already noted in these columns, and the International Engineering Congress scheduled for the same city during the week immediately following the Electrical Congress.

The proceedings of the Electrical Congress will deal exclusively with electricity and electrical applications. Its work will be divided into twelve sections and about 250 papers will be presented. This congress is held under the auspices of the American Institute of Electrical Engineers by authority of the International Electrotechnical Commission. Dr. C. P. Steinmetz, Schenectady, N. Y., has accepted its honorary presidency, and Dr. E. B. Rosa, Washington, D. C., its honorary secretaryship. Mr. H. G. Stott, New York, is chairman of the executive committee on organization, and Mr. Preston S. Millar, New York, is secretary-treasurer.

The International Engineering Congress, on the other hand, will deal with engineering in a general sense, its electrical-engineering subjects being limited to one of its eleven sections, before which about twelve papers will be presented treating more particularly of the use of electricity in engineering work. The engineering congress is supported by the Societies of Civil, Mechanical and Marine Engineers and by the Institutes of Mining and Electrical Engineers, as well as by prominent Pacific Coast engineers who are actively engaged in organizing it.

The meeting of the International Electrotechnical Commission will be held at San Francisco during the week preceding that of the Electrical Congress.

## New York State Automobile Census

Net receipts of $1,275,000 were received for licenses and registration certificates for the year up to Dec. 12 by the New York State Automobile Bureau. For the corresponding period in 1912 the total was $1,060,000, and in 1911 $905,000. This year there were registered 133,000 owners of motor vehicles, 57,000 chauffeurs and 1800 dealers, against 105,000 owners, 45,000 chauffeurs and 1700 dealers in 1912. The increased use of commercial cars is one of the most notable features of the year. There are over 13,000 of these, which shows a gain of 61 per cent over last year.

## Christmas Decorations at Davenport, Ia.

The retail merchants on Second Street, Davenport, Ia., are among the city's most enterprising "boosters" and let no opportunity escape for seasonable advertising. The Christmas season of 1913 found them attracting the attention of the public by means of the novel electrical display illustrated herewith.

On both sides of the street the top globes and lamps were removed from the five-lamp ornamental standards and were

CHRISTMAS DECORATIONS AT DAVENPORT, IOWA

replaced by small Christmas trees firmly attached to the tops of the posts. Wound about each tree a circuit of miniature red and green lamps, supplied with energy from the unused top sockets, lent holiday cheer to the street decorations during evening shopping hours. Wreaths of green festooned about the shafts of the standards added to the effectiveness of the display by daylight.

Other neighboring merchants adopted a somewhat different method of Christmas decorations. In addition to stringing the festoons and wreaths on the posts, colored lamps were inserted in the Alba globes of the standards so that at night the top globe of each post glowed a deep red while the four lower lamps beamed with an emerald-green color. In some individual instances strings of red, green and yellow incandescent lamps were also added to the decorations.

The displays were paid for by the retail dealers, each subscribing equally to the outlay. Credit is also due the People's Light Company, of Davenport, from whose mains the energy was taken, for its assistance in carrying out the merchants' plans.

## Secretary of the Interior on Water-Power Development

The annual report of Mr. Franklin K. Lane, Secretary of the Interior, says in reference to water-power development:

"Within a generation I believe the people will be as alive to the value of public ownership of hydroelectric power plants as they are to-day to municipally owned water-works. The people not being prepared, however, to proceed to put these lands to their highest use, I am not in favor of keeping them from being utilized by private capital in the public interest. That we do not know what is best to be done is not a reason either for doing nothing or for getting rid of the trouble as soon as possible, on the old 'land-is-land' policy.

"What return shall the federal government have for its lands? My answer would be, no return whatsoever, provided the plant reverted to the government without cost at the end of fifty or sixty years, or so much of the plant as was based on the land itself and the improvements directly attached thereto, such as reservoirs, dams, water rights, and rights-of-way. For the tangible property of the plant, such as the distributing system and machinery, the government might well agree to pay an appraised price so as to insure its being maintained and extended during the later years of the life of the franchise. The right to buy the complete plant at an appraisal figure at any time after twenty years would be a further protection and one not burdensome, while for better service it would seem advisable that all plants be permitted, in fact encouraged, to combine physically, but they should not be allowed either to agree as to rates or to merge their capitalization or their identity."

## Municipal Plant at Deckerville, Mich., Wrecked by Explosion

As the result of an explosion of the pressure tank at the municipal electric plant in the village of Deckerville, Mich., on Dec. 9, the building was partly wrecked and the whole plant was put out of commission. Mr. C. A. Sink, the village electrician, and his assistants narrowly escaped death from falling wreckage and escaping steam. The explosion came without any warning. The pressure tank is of considerable size and normally it contains water under an air pressure of about 75 lb. The cause of the accident is unknown. Superintendent Sink had just arrived at the plant a few minutes before the accident occurred. He made an examination of the steam, water and air gages and found all of them indicating normal pressure. Then he proceeded to inspect a shaft bearing within a few feet of the pressure tank. He was standing between two large belts when the explosion occurred and was unable to give any explanation of the manner in which he escaped from the wreckage.

The accompanying picture of the ruins was taken on the morning after the explosion. Measures were taken at once to repair the damage, and within two weeks the plant was again placed in operation. Electrical energy from this plant is used to operate the village water-works and for several days the town was without a water supply. By utilizing

DECKERVILLE (MICH.) MUNICIPAL ELECTRIC & WATER PLANT AFTER EXPLOSION OF DEC. 9

some old steam pumps, however, the water supply was resumed within four or five days, but for two weeks the village was without electric light, and several local industries, as the grain elevator and grist mill, were without energy for motors. The Deckerville *Recorder* was unable to obtain electricity to operate its linotype machine and presses during that period.

## Joint Meeting of Engineers at Boston

Before a joint meeting of the Boston Society of Civil Engineers and the Boston sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers on Dec. 18, Mr. B. A. Behrend, of Boston, Mass., gave an illustrated lecture upon a disaster which occurred in the spring of 1908 in the power house of the Niagara Falls Hydraulic Power & Manufacturing Company, when a 12,000-hp generator was wrecked while undergoing a speed test prior to acceptance by the purchaser. The speaker discussed the accident in an informal manner and drew a number of lessons from the occurrence which he contended must be heeded in successfully handling the design and construction of large generating units. Among these are the importance of thorough attention to details of design on the part of engineering executives in manufacturing plants; the most careful selection and accurate testing of materials, particularly alloy steel, subjected to heavy mechanical and magnetic strains; insistence upon the taking of test samples at specified locations; a broader knowledge of the weakening effects of improper machining and the use of unsuitable tools in the preparation of castings and forgings; the value of the cold bending test as compared with tensile strength observations; the study of the capabilities of subordinates; need of scientific shop inspection, and the exercise of eternal vigilance in dealing with the enormous forces involved in modern high-powered machinery.

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## Water-Power Conservation Hearings in Massachusetts

The special legislative commission on water-power conservation created by a resolve at the 1913 session of the Massachusetts Legislature held a series of hearings last week at Springfield, Pittsfield and Greenfield, a final hearing being conducted at Boston on Dec. 18. Hon. W. S. McNary, chairman of the Massachusetts Harbor and Land Commission, presided at each session. At the Springfield hearing, which was given on the morning of Dec. 15, Herbert Myrick, of Springfield, addressed the board on behalf of the acquisition of water rights by the State, contending that by this method small power users would be enabled to enjoy the benefits of cheap hydroelectric service. Messrs. F. G. Hodskins and A. W. Gilbert also spoke in behalf of a more public development of the streams. Mr. Charles H. Tenney, head of the Tenney central-station companies, whose headquarters are at Boston, favored conservation of water-power, but maintained that it should be developed by private capital so far as possible. The point was made that the development of such power by responsible private corporations is of sufficient value to the public as a whole to justify its sale upon a wholesale basis.

At Pittsfield Frederick N. Fowler, a hydraulic engineer, emphasized the importance of water conservation along the Housatonic River. Representatives of large paper-manufacturing plants appeared in favor of improved control of flood waters. Selectman T. J. Kearin, of Great Barrington, said that in his opinion the residents of that town would willingly contribute their share of a tax for the conserving of the waters of the Housatonic River by the State. Mr. C. H. Wright, representing the General Electric Company and other manufacturers, urged that the same laws be applied to Massachusetts water-power development as to waters under federal control.

At the Greenfield sitting of the board Mr. C. S. Davis, counsel for the Turners Falls Power Company, cited the benefits of storage reservoirs on streams subject to sharp variations in flow, pointing out that in some instances half the power of a river is lost through insufficient storage. Mr. Clarke C. Fitts, of Brattleboro, Vt., stated that there lies unused in Vermont at present the water-power equivalent of 500,000,000 tons of coal per year, which should be developed by proper conservation.

The final hearing of the commission was held at Boston on Dec. 18. President Henry I. Harriman of the Connecticut River Transmission Company, Boston, outlined the developments of the New England Power Company on the Deerfield River, emphasizing the value of storage at the head of a high fall. The Connecticut River, New England's largest stream, is not well adapted to large storage plans.

Mr. Harriman opposed the direct creation of storage by the State unless it can be shown that other plans fail to conserve the public interests. He also objected to the plan set forth in the Millers River bill by which the functions of the State would be delegated to private interests under close control. A paper-mill owner cannot afford to pay as much for water as a textile manufacturer or an electric-service company. Water-power has a variable value among different industries. In closing Mr. Harriman said that not more than 15 per cent of the water-powers of Massachusetts would pay the cost of development.

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## Settlement of American Telephone & Telegraph Suit

An announcement was made at Washington on Dec. 19 of a settlement between the American Telephone & Telegraph Company and the government, represented by Mr. James C. McReynolds, Attorney-General, of the litigation against the company under the Sherman anti-trust law. Letters confirming the settlement passed between Mr. N. C. Kingsbury, vice-president of the company, and Attorney-General McReynolds. Statements in reference to the matter were made by President Wilson and Mr. Theodore N. Vail, president of the company.

In his letter to the Attorney-General, Mr. Kingsbury stated the basis of the plan of agreement. The company will dispose of its Western Union Telegraph Company stock, so as to leave the control and management of the latter company entirely independent of any company in the Bell system. No company in the Bell system will hereafter acquire, either directly or through purchase of securities, control over any other telephone company owning, controlling or operating any exchange or line which is or may be operated in competition with any exchange or line included in the Bell system, or which constitutes or may constitute a link or portion of any system so operated, or which may be so operated in competition with any exchange or line included in the Bell system. Where control of the properties or securities of any other telephone company has been acquired heretofore and no physical union or consolidation has been effected, or where binding obligations for the acquisition of the properties or securities of any other telephone company have been entered into by or in the interest of any company in the Bell system and no physical union or consolidation has been effected, the question as to the course to be pursued in such cases will be submitted to the Attorney-General and to the Interstate Commerce Commission for advice and directions. Arrangements will be made promptly under which all other telephone companies may secure for their subscribers toll service over the lines of the companies in the Bell system.

In his letter Attorney-General McReynolds said:

"May I take this occasion to say that the administration earnestly desires to co-operate with and to promote all business conducted in harmony with law and that, without abating the insistence that the statutes must be obeyed, it will always welcome opportunity to aid in bringing about whatever adjustments are necessary for the re-establishment of lawful conditions without litigation?"

Mr. Vail said that the company is complying with the wishes of the government because it desires that its opera-

tions shall continue to be, as it has always believed them to be, in strict conformity to the law, and for that reason it is now adjusting them to the law as understood and interpreted by the Attorney-General. He said that he is confident that under the proposed changes neither the Bell system nor the Western Union company will suffer. Some economies and some services which were contemplated under the complementary operation of the two companies cannot now be realized, but it is hoped that all now in operation will, after thorough consideration, be found to be within the law. In relinquishing the Western Union Company, the American company does so with the satisfaction of knowing that it is in better physical and financial condition than when it was taken over, and that the shareholders will soon be benefited in some measure by what has been done.

In speaking of the working relations between the two companies Mr. Vail said that the two organizations had been kept separate, so that no disorganization will result from this separation.

The letter of President Wilson to Attorney-General McReynolds said: "It is very gratifying that the company should thus volunteer to adjust its business to the conditions of competition. I gain the impression more and more from week to week that the business men of the country are sincerely desirous of conforming with the law, and it is very gratifying indeed to have occasion, as in this instance, to deal with them in complete frankness and to be able to show them that all we desire is an opportunity to co-operate with them. So long as we are dealt with in this spirit, we can help to build up the business of the country upon sound and permanent lines."

Notwithstanding the settlement of the suit, Congressman Lewis, of Maryland, delivered a long speech in the House of Representatives on Dec. 22 in support of his resolution providing for government ownership of telegraph and telephone lines.

## The Electric Vehicle at Boston

The New England Section of the Electric Vehicle Association of America held a meeting at Boston on Dec. 18, Chairman J. A. Hunnewell presiding. Mr. Charles F. Smith, of the Boston Edison Company, read a paper describing the new electric garage of the company at the Massachusetts Avenue service buildings and outlined the work of the transportation department. The automobile equipment of the company now consists of 116 machines in use and 29 on order, 87 of which are electric vehicles. A full description of the garage will be published in a later issue. In a brief discussion which followed the paper garage practice in Salem and Lowell, Mass., was described. In the latter city the central-station company successfully charges ignition and lighting batteries at a rate about 30 per cent above that of private garages. Mr. H. H. Skinner, of the Narragansett Electric Lighting Company, Providence, R. I., reviewed the growth of the electric-truck business in that city and stated that during 1914 at least ten more trucks would probably be purchased by a single department store.

The Electric Motor Car Club of Boston held its Christmas meeting at the Hotel Thorndike on Dec. 22, sixty members and guests being on hand to enjoy the festivities incidental to the holiday season. During a brief business session General Superintendent W. H. Atkins of the Boston Edison Company offered the use of a 100-ft. by 60-ft. tent for an out-door exhibition of electric vehicles next spring in various New England cities, such as Worcester, Providence and Springfield, where the local central stations are vigorously co-operating with the Boston campaigners. Mr. S. Fred Smith, of Salem, and Mr. J. A. Hunnewell, of Lowell, Mass., expressed the interest of the Tenney and Stone & Webster local properties in the plan and offered to co-operate in the supply of electricity, labor and in local publicity in making the tent show a success. Two-day "stands" are contemplated.

## Electrification System Discussion

In a paper presented by Mr. A. H. Armstrong, Schenectady, N. Y., before the Canadian Society of Civil Engineers at Montreal on Dec. 18, statistics were given to show that of the twenty-eight single-phase railway systems placed in service in the United States and Canada between 1904 and 1911 nine have been replaced by direct-current systems and that thirty direct-current installations have been placed in successful operation at voltages ranging from 1200 to 2400 since October, 1907. The author stated that all of the last-mentioned equipments are giving satisfaction and that no change of type of equipment has been made or contemplated.

In the accompanying table is shown the author's list of converted steam lines where the service consists in hauling main-line passenger and freight trains behind large electric locomotives. The author remarked that the use of the single-phase motor has not extended beyond the two original roads installing this type of equipment, the Grand Trunk and the New York, New Haven & Hartford (including the Hoosac Tunnel installation), whereas direct-current motors have been universally adopted in all the more recent electrifications with the single exception of the proposed split-phase installation on the Norfolk & Western Railway. He said that the so-called "split-phase" system is comparatively a newcomer in the electric traction field and it has not yet been subjected to the test of actual operation. The proposed system offers many attractive features, however, and it is worthy of careful study in order to understand its fitness for heavy electric railway service. From experimental tests made, it seems reasonably certain that the split-phase locomotive can meet the demands of commercial operation with satisfactory reliability. The split-phase locomotive was described on page 367 of our issue dated Aug. 23, 1913, and on page 731 of the issue for Oct. 11, 1913.

MAIN-LINE ELECTRIFICATION—UNITED STATES AND CANADA

| Installation | Year | Type Locomotive | System | Voltage |
|---|---|---|---|---|
| St. Clair Tunnel | 1908 | Geared | Single-phase alternating | 3,300 |
| N. Y., N. H. & H. | 1907 | Gearless | Single phase-alternating | 11,000 |
| Hoosac Tunnel | 1911 | Geared | Single-phase alternating | 11,000 |
| Cascade Tunnel | 1909 | Geared | Three-phase alternating | 6,600 |
| *Norfolk & Western | 1914 | Geared side rod | Split-phase alternating | 16,500 |
| B. & O. Tunnel | 1895 | Geared | Direct current | 600 |
| New York Central | 1906 | Gearless | Direct current | 600 |
| Detroit Tunnel | 1910 | Geared | Direct current | 600 |
| Pennsylvania Terminal | 1910 | Side rod | Direct current | 600 |
| Butte, Anaconda & Pacific | 1913 | Geared | Direct current | 2,400 |
| *Canadian Northern | 1914 | Geared | Direct current | 2,400 |
| *Canadian Pacific | 1914 | Geared | Direct current | 2,400 |

*Under construction.

The paper was devoted largely to a comparison of alternating-current and direct-current locomotives. The author claimed that lack of appreciation of the fundamental facts involved has perhaps been the basis of the false hopes raised as to the possible advantages resulting from the installation of the single-phase trolley. He said that it surely does look attractive to install a system employing 15,000 volts on the trolley, no feeder copper and no rotating substation apparatus. But investigation and experience disclose the fact that the single-phase trolley is a decided menace to neighboring circuits, feeder copper is required for return circuit, substations are comparable as to first cost and efficiency with direct-current substations and, finally, the alternating-current locomotive of the most promising

type, the so-called split-phase combination of induction motors, transformer and phase converter, is heavy expensive, complicated and inefficient to a degree that would not be tolerated in direct-current construction. Assuming that the favorable results of factory experiments are borne out in the success of later commercial operation, there appear to be no controlling advantages of alternating-current locomotive traction which cannot be secured at less expense and with greater reliability in operation with direct-current motive power.

The high-voltage direct-current motor has now been developed, built and proved completely successful under the most exacting service conditions. The trolley potential has been raised to 2400 volts which seems sufficiently high to insure a distribution system of reasonable first cost and not too high to handicap the locomotive as regards its first cost, reliability and operating efficiency. Experimental results already obtained with direct-current apparatus tested at potentials higher than 2400 volts indicate that no construction difficulties apparently exist and the installation of a higher voltage becomes an economic question rather than an engineering problem.

With 2400 volts direct current both protected third-rail construction and multiple-unit car operation are feasible. The third-rail offers advantages in accessibility and low cost of maintenance on single-track roads and multiple-unit car operation is without question the proper way to take care of local traffic. Furthermore, 2400-volt equipments can be successfully operated upon the lower voltage terminal zone that local restrictions may make necessary.

It is popularly supposed among electrical engineers that the cause of electric traction is retarded by any openly expressed divergence of views as to the relative merits of different systems of electrification. The opinion is advanced, on the contrary, that a free presentation of the facts available, but not always made public, will do much to clarify the situation. No one contributing cause has done more to hurt the electric railway industry than the failure of the single-phase system to make good the too optimistic claims of its early advocates.

The direct-current motor is fully able to meet all the requirements of the heaviest passenger and freight train operation, as proved by the entirely successful installations now running and which afford convincing facts upon which statements of costs and operation are based. The author maintained that no such condition exists with any alternating-current locomotive system and that the operating facts obtainable are not of a nature to inspire confidence in selecting such a system to meet the exacting requirements of heavy electric railroading.

*Discussion*

In the discussion which followed the presentation of the paper Mr. H. H. Vaughan, vice-president of the Canadian Pacific Railroad, referred to the adoption of high-tension direct current for a section of that railroad. This installation involved 30 miles of route and 43 miles of track with a long 4 per cent grade, the operation being carried on by four locomotives. The battle of the systems, he said, had deterred steam railroad men from adopting electricity for motive power; but in the case cited the two systems were found to be practically alike in first cost and in maintenance, direct current being chosen because it was considered more advantageous to use a system in which the larger part of the investment was involved in the cost of copper for feeders, rather than in locomotives which might soon become obsolete. Moreover, the development of the gearless locomotive and the improved methods of collecting large currents had helped toward the decision in favor of direct current.

In a written communication Mr. George Gibbs, New York, stated that practical railway men have been unable until recently to obtain any clear idea of the possibilities of heavy electrification because of the befogging of the whole problem by the controversial attitude of conflicting interests. Each system has been set forth by its promoter as having all the virtues and none of the faults of the other systems, and this has raised doubts in the minds of railway men if any system is really reliable. During the last year or two, however, there has appeared an inclination on all sides to admit that the art is a developing one and that each system had its own particular field of best employment. He remarked that the paper appeared to have gone back to the old method of special pleading for some particular system, setting forth in an unfavorable light the defects of competing systems, while the disadvantages of the system advocated are not even referred to. The engineer should set forth, as completely as his space will permit, the advantages of each system and make his recommendation in accordance with all the facts set forth. The reader, having the balance sheet before him, can then check the conclusions.

The author dismissed the single-phase system as unsuitable for main-line traction, apparently from unsatisfactory results on a number of interurban traction lines which found it advantageous to change over from single-phase to direct current. Probably these roads never should have used single-phase because their conditions did not suit this form of power, and, in any event, their case is not parallel to that of heavy steam traction.

After summarily dismissing the single-phase motor, the author then proceeded to advocate high-tension direct current, apparently for all classes of work, and appeared to think the split-phase locomotive its only serious competitor. The fact that single-phase contact and split-phase locomotives were adopted on the Norfolk & Western Railway for the heaviest electric traction work yet undertaken anywhere requires some explaining away, because there are presumably reasons to believe that the adoption of this system was made after some study of the local situation and the conclusion arrived at that the system had preponderating advantages for the work in question.

Mr. Gibbs upset the author's "safe prediction" that "no more single-phase motor equipments will be placed in operation in this country on new roads unless these roads virtually form an extension of existing systems" by calling attention to the very recent adoption of the single-phase motor-car system of operation for the Pennsylvania Railroad suburban lines out of Philadelphia.

Mr. Edwin B. Katté, chief engineer of traction New York Central & Hudson River Railroad, submitted a written communication in which he stated that an electric locomotive capable of hauling an 800-ton passenger train at 60 miles per hour is too small to be seriously considered by steam railroad men operating important trunk lines. The modern electric passenger locomotive must be able to haul a train of cars weighing from 1000 to 1200 tons. Electric companies frequently confuse railroad men by including the locomotives when they refer to a train of a given weight. Moreover, such a locomotive should be capable of performing the regular service practically continuously and not after a few hours of operation be laid up in the terminal from one to three hours to allow the motors to cool off. Mr. Katté said that electric operation is a good thing in the proper place, although it does cost considerable money and has some limitations.

Mr. W. S. Murray, New Haven, referred to Mr. Armstrong's paper as the highest card yet played in favor of single-phase for main-line traction and direct current for interurban and local railroad service. He claimed that the actual power required to carry a given weight is 22 per cent more with direct current than with alternating current. A direct-current locomotive may be excellent, but one must not ignore other features of the system as a whole.

Mr. Murray noted the omission by Mr. Armstrong of mention of the single-phase installations on the Spokane & Inland Empire Railroad and the New York, Westchester & Boston Railroad, on which steam would have been used had electricity not been at hand. Mr. Murray attributed to the paper the merit of marking plainly the desirability of using the single-phase system in the field where all engineers who are free from commercial bias have already placed it.

## Public Service Commission News

### Illinois Commission

Governor Dunne of Illinois has appointed Mr. Frank H. Funk, of Bloomington, Ill., a member of the Railroad and Warehouse Commission. It is believed that this means that Mr. Funk will be a member of the State Public Utilities Commission of Illinois, which will come into existence after Jan. 1, succeeding the Railroad and Warehouse Commission.

### Wisconsin Commission

The Wisconsin Railroad Commission has passed upon the application of the Waukesha Gas & Electric Company for an increase in rates and has issued a decision ordering a reduction in rates for electric service and a revision of the rates for gas service.

The decision notes that the American Gas Company, which controls the property, is primarily interested in the gas business. Its effort has been directed toward the extension of the gas business and little or nothing has been done, except recently, to further the sale of electricity, with the result that the company has one of the best-developed gas businesses in the State and about the most poorly developed electric business. In commenting upon this condition of affairs, the commission says: "Companies holding indeterminate permits, whether for single or joint utilities, have assumed the responsibility for the highest reasonable development of their business as well as for adequate distribution and sale."

The utility contended that it was entitled to a considerable amount for going value. In view of the existing conditions, the commission held that it would be an injustice to force the consumers to bear the costs resulting from "what might be termed the neglect of the management to stimulate properly the sale of the utility's product."

An analysis of the electric consumer data showed that the number of consumers is considerably less than it should be and that, furthermore, the consumption per consumer is unreasonably low.

In view of these facts, the commission held the opinion that a schedule of rates designed to develop the business in the way of increased lighting consumption would be more advisable than a schedule formulated to produce an adequate return under existing circumstances. Attention was called to the fact that the motor service, with a consumption of over five and one-half times that of lighting, contributed only 9 per cent more to the total revenues. The high rates for lighting service as well and the failure of the company in the past to push the sale of electrical energy are held responsible for the very poor development of the business. The present rates for electric lighting range from 15 cents per kw-hr. to 10 cents per kw-hr. The schedule prescribed by the commission is as follows: Primary rate, 12 cents for the first thirty hours' use per month of the active connected load; secondary rate, 9 cents for the next sixty hours' use; excess rate, 6 cents. The classification of consumers, according to the percentage of their active connected load, is the same as was employed by the commission in past decisions. On the basis of last year's sales, the schedule as prescribed will effect a considerable reduction in revenue.

# Current News Notes

New Idaho Electric Plant.—According to present plans, the hydroelectric plant of the Utah Power & Light Company at Grace, Idaho, will be placed in service on Jan. 1, 1914. Energy from this plant will be transmitted to the new substation at Salt Lake City, 135 miles, over a steel-tower line now being erected.

* * *

Electricians Ask Raise.—Employers throughout New York City have received circulars from the Inside Electrical Workers of Greater New York, signed by Mr. G. Whitford, secretary, informing them that on and after Jan. 1, 1914, the wages of those workers will be increased 30 cents a day. The present wages of the inside electrical workers are $4.50 a day.

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Boiler-Feed Water by Rail.—A severe shortage of water in central Kentucky has necessitated that the Lancaster Electric Light Company arrange to have its supply furnished by rail. Two storage tanks each of 8000-gal. capacity have been provided, and all the boiler-feed water will be brought from outside until local conditions improve. The service has not suffered interruption thus far.

* * *

Vice Versus Light.—"Most of the wickedness of the world is committed after dark," writes Dr. Orison Swett Marden in a recent practical preachment on purity. "A fraction of the frightful expense in great cities caused by crime, if expended in lighting up all the dark, dismal places of the city, especially the slums, making the streets and alleyways as nearly light as possible, would diminish crime immensely and would prove a tremendous investment for the city."

* * *

Study Niagara Water-Power.—The legislative committee for the purpose of studying the diversion of Niagara Falls water for power purposes and reporting back to the New York State Legislature, to the end that the State may formulate a settled policy for dealing with the problem, held a preliminary session in Buffalo on Dec. 15. The committee made an inspection of the power plants at Niagara Falls and held a public hearing in Buffalo on Dec. 17. Senator Henry P. Velte is chairman of the committee.

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Inquiry Into the Generation and Utilization of Electricity.—The Oregon Hydroelectric Commission, which had its inception in a plan advanced at the commonwealth conference at the University of Oregon last spring, held its initial meeting at the Portland Chamber of Commerce on Dec. 13. The purpose of the commission is to arrange for funds to conduct a world-wide study of electric power and the methods and cost of its production and application to manufacturing industries, with the view to formulating a basis on which the vast water-power resources of Oregon may be developed.

* * *

International Joint Commission to Meet.—A meeting of the International Joint Commission will be held in Washington, beginning on the morning of Jan. 13. The commission will consider the application of the Michigan Northern Power Company for authority to build a dam for power purposes at Sault Ste. Marie; also the application of the Greater Winnipeg water district to divert water from Shoal Lake, west of the Lake of the Woods, for the purpose of a water supply for Winnipeg. The commission will also take up the report of the sanitary experts in connection with the pollution of boundary waters investigation.

EYE STRAIN AND TELEPHONE SWITCHBOARDS.—According to a recent report of the American Medical Association, eye strain is to blame for the harm to the health of telephone-switchboard operators, whose average length of service even under good conditions does not exceed three years. To complete one call means four flashes of light, and investigations show the operator's eyes are exposed to from 500 to 1000 flashes of light every hour. Headache, dullness, indigestion, exhaustion, nervous strain, insomnia and colds are some of the symptoms that follow this work.

* * *

EXAMINATION FOR LABORATORY ASSISTANT.—An open competitive examination for laboratory assistant will be held by the United States Civil Service Commission on Jan. 21 and 22, 1914. From the successful candidates selection will be made to fill vacancies in the Bureau of Standards, Department of Commerce and Labor. The work is similar to that in the better class of industrial and scientific research laboratories. Applicants must be between the ages of twenty and thirty-five years. The salaries range from $900 to $1,200 per annum. Those interested should send for Form 1312 to the United States Civil Service Commission, Washington, D. C.

* * *

PATENT COMMISSION INDORSED BY CHAMBER OF COMMERCE OF STATE OF NEW YORK.—The following resolutions bearing on the patent bills now pending in Congress and the movement for the appointment of a patent commission were recently adopted by the Chamber of Commerce of the State of New York: "The Chamber of Commerce of the State of New York favors the creation of a competent expert commission to study the subject and to recommend such changes in the patent laws, the Patent Office procedure and the court review of patent cases as may appear necessary to promote the interests of inventors and give substantial justice to the public."

* * *

TELEPHONE OPERATORS AND ELECTRIC SHOCK.—In two recent cases carried to the Appellate Court of the First District of Illinois the Chicago Telephone Company was defendant, the plaintiffs being young women employed by the company as telephone switchboard operators who had brought suit for injuries received in the discharge of their duty and alleged to be due to electric shock. The verdict of the lower court awarding one girl $2,000 damages for a shock which caused an abscess to form in her left ear was sustained. Another operator asserted that she sustained a shock by reason of a cord which was not insulated. In this case the company was found not guilty in the lower court, and that verdict was upheld also.

* * *

RADIO AND BRAIN.—Mr. Burton F. Babcock, Syracuse, N. Y., has called our attention to some interesting original observations concerning radio-telephony, as follows: "I believe it has been my good fortune to make a discovery in regard to wireless electricity which will astonish the civilized world when it has been thoroughly tested. A few hundred volts of wireless, controlled into small strong continuous current only a few inches in diameter, will not only convey sound in the form of ordinary conversation, but will transfer thought from brain to brain. When accustomed to this method of communication a conversation can be carried on at a distance of several miles without any audible sounds whatever. Bodily pain inflicted on one person in the current is instantly felt by the other to almost an equal extent. Please notify some expert electricians in order that all may learn its possibilities."

* * *

A GAS-ELECTRIC TRAIN FOR THE KHEDIVE OF EGYPT.—For the use of the Khedive of Egypt a gas-electric train of two cars has just been completed, the unusual feature of which is the equipment of both cars with individual gasoline-engine-generator sets, the entire driving equipment being susceptible of control from either end. Each four-cylinder engine is rated at 120 hp and runs at 700 r.p.m. For safety, the gasoline fuel is stored under gas pressure in a tank beneath the car. The generators are rated at 80 kw and at 300 volts can be drawn upon for currents up to 500 amp during starting. Each coach is gear-driven by a pair of 80-hp auxiliary-pole motors. The complete 100-ton train is capable of speeds up to 40 miles per hour with both sets in operation, although in case of accident either unit can be used to propel the pair. The compartments of the cars are lavishly equipped, as the train will be used by the Khedive in his official journeys.

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PUBLIC OWNERSHIP IN WISCONSIN.—With the order of the Wisconsin Railroad Commission for turning over the property of the Beaver Dam Water Company to the city at $133,000, thirteen plants have been purchased by cities under the Wisconsin utilities law. In three cities the properties have been taken over in the last few weeks, and three cases are pending in which the valuation has been almost completed. The cities paid an aggregate of $2,404,900 for the plants. Among the purchases were: Electric plant at Cashton, $3,100; electric plant at Brodhead, $40,000; electric plant at Manitowoc, $137,500, and the electric plant at Kaukauna, $50,000. The commission is now valuing the Racine water plant, worth nearly $1,000,000; the Janesville water works, and the electric plant of the Grand Rapids Electric Company. In Manitowoc there is some agitation favoring the city purchasing the gas plant in addition to the electric plant and water-works already acquired.

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CONSERVATION THROUGH RAILWAY ELECTRIFICATION.—Mr. G. Percy Cole, of the Canadian General Electric Company, addressed the members of the Canadian Railway Club recently on "The Conservation of Natural Resources Through the Electrification of Railways." He spoke of the enormous cost of running locomotives by coal and estimated that the annual consumption of coal by locomotives in Canada and the United States is approximately 110,000,000 tons. If it were possible, he said, to save two-thirds of this, valued at $2 per ton, a yearly saving of roughly $147,000,000 would be effected, which would go a long way toward paying for electrification of railways. Dr. L. A. Herdt and Professor McKay, of McGill University; L. C. Ord, of the Canadian Pacific Railway; W. H. Winterrod, electrical engineer of the Canadian Pacific Railway, and R. H. Wheeler, electrical engineer of the Canadian Northern Railway, took part in the discussion which followed the address.

* * *

VETERANS OF CHICAGO BUREAU OF ELECTRICAL INSPECTION.—Dec. 10, 1913, was the thirtieth anniversary of the passing of the ordinance creating the bureau of electrical inspection for the city of Chicago, and employees of the bureau, former city electricians, with a few invited guests, celebrated the event with a banquet. As a part of the evening's program, silver stars were presented to each employee of the bureau who has been in the service more than fifteen years. Messrs. Daniel Battle, Arthur Demond, Edward La Plante, Charles Van Cleaf, Henry Horstmann and J. J. Finan were recipients of this honor. As a mark of the appreciation of the services of Mr. Victor H. Tousley, present chief electrical inspector, a gold star was presented to him. Mr. E. B. Ellicott, first city electrician for Chicago, made the presentation speech. In his remarks as toastmaster Mr. Tousley sketched the growth of the bureau from its beginning in 1883, when there was but one electrical inspector and the entire expenses of the bureau were about $1,000 annually, up to the present date, when the institution has sixty-seven employees and spends $100,000 a year.

Flat Rates for Apartment Houses.—A woman customer giving the address of an uptown apartment recently approached the window clerk in the Duquesne Light Company's office, Pittsburgh, Pa., and complained that the company was not charging her a "flat rate." She thought surely she was entitled to a flat rate, she said, because she lived in a flat.

* * *

Des Plaines River Water-Power Litigation.—Briefs were filed for both sides in the United States Supreme Court at Washington on Dec. 15 on the writ of error taken by the State of Illinois in the case against the Economy Light & Power Company of Joliet, now merged into the Public Service Company of Northern Illinois. The decision from which appeal was taken was the result of action brought by the Governor for the State of Illinois to enjoin the company from building a dam across the Des Plaines River at Dresden Heights, Ill., and to set aside a deed from the commissioners of the Illinois & Michigan Canal. The action was brought on the ground that the Des Plaines River is a navigable river. On a hearing in the state courts the bill of the State of Illinois was dismissed for want of equity and the state Supreme Court sustained this decree.

* * *

Electric Company Liable for Damages to Shade Trees.—Inasmuch as electric light companies do a great deal of tree trimming at this time of the year, the case recently decided by the Supreme Court of North Carolina (Moore vs. Carolina Power & Light Company, 79 S. E. Rep., 596) is of interest. The plaintiffs were abutting owners of property on a city street. The electric light company, for the purpose of facilitating the use and operation of its lines and poles, trimmed certain shade trees bordering on the street in front of plaintiffs' property. Suit was brought for damages alleging depreciation of plaintiffs' property because of the impairment of its use and enjoyment resulting from the above depredation. The defense was interposed that as the fee in the streets belonged to the State, and as defendant company was a quasi-public corporation, plaintiffs had no rights against the company that could interfere with any impairment of the trees for its convenience. The Supreme Court of North Carolina, however, while holding that a municipal corporation which enjoys the possession of its streets has absolute control over bordering trees provided that no oppression is exercised impairing the rights of abutting owners in their easements in the shade of the trees, yet decided that this municipal power of control was not delegable and could not be conferred upon even a quasi-public corporation, with the result that defendant company was required to be responsible for any damages resulting.

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## SOCIETY MEETINGS

Revised Dates for Southwestern Convention.—The annual convention of the Southwestern Electrical & Gas Association is to be held at Galveston, Tex., Wednesday to Saturday, May 20 to 23, 1914, instead of on the dates previously announced. Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex., is secretary of the association.

* * *

January Meeting, Chicago Section, I. E. S.—The January meeting of the Chicago Section of the Illuminating Engineering Society will be held jointly with the Chicago Architectural Business Men's Association. Mr. J. B. Jackson, of the Illuminating Engineering Society, will address the joint session on the subject "Planning Lighting Installations."

* * *

Independent Telephone Association Meeting.—The seventeenth annual meeting of the National Independent Telephone Association is to be held at the Hotel La Salle, Chicago, from Jan. 13 to 15, 1914. A program of special interest to telephone men is being arranged. Mr. J. B. Earle, Waco, Tex., is the new secretary-treasurer of the society. Mr. N. Thompson, 1404 McCormick Building, Chicago, Ill., is assistant secretary.

* * *

Seattle Section, A. I. E. E.—The annual meeting of the Seattle Section of the American Institute of Electrical Engineers was held in Seattle Nov. 18. Mr. S. C. Lindsey, electrical engineer for the Puget Sound Traction, Light & Power Company, was elected chairman as successor to Mr. J. D. Ross, of the Seattle municipal plant, and Mr. E. A. Loew, assistant professor of electrical engineering at the University of Washington, was elected secretary-treasurer, succeeding Mr. Magnus T. Crawford.

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New York Section, I. E. S.—At the meeting of the New York Section of the Illuminating Engineering Society to be held Jan. 8 the topic of "Residence Lighting" will be discussed by Messrs. A. L. Powell and Thomas Schofield. Mr. Powell will treat the subject from the electric-lighting standpoint and Mr. Schofield will describe recent progress made with the use of gas. On Feb. 11 the section will hold a joint meeting with the New York Municipal Art Society, when Mr. C. F. Lacombe, chief engineer of light and power for the city of New York, will present a paper entitled "Street Lighting Abroad."

* * *

Depreciation of Utility Properties.—A paper on "The Depreciation of Public Utility Properties as Affecting Their Valuation and Fair Return" was presented on Dec. 17 by Mr. John W. Alvord, of Chicago, before the New York Section of the American Society of Civil Engineers. The paper was discussed by Messrs. Alexander C. Humphreys, Frederick Lavis, Henry Floy and Charles Rufus Harte. A written discussion by Mr. W. J. Wilgus was read. Owing to lack of time written discussions by the following were read by titles: Messrs. J. E. Willoughby, Frank C. Boes, Allen Hazen, H. C. Vensano and Leonard Metcalf.

* * *

St. Louis Engineers Enjoy Themselves.—Largely owing to the efforts of an entertainment committee, of which Mr. H. Spoehrer, of the Union Electric Light & Power Company, was chairman, the annual dinner of the Engineers' Club of St. Louis on Dec. 17 was a particularly enjoyable affair. The invitations were in the form of a contract drawn up in regular form, by which the club agreed to furnish the party of the first part one jovial evening in consideration of a certain sum of money in hand paid. The specifications were set forth "as follows, to wit" (with accent on the "wit"). Mr. John Hunter, chief engineer of power plants for the Union Electric Light & Power Company, was the retiring president, and with some flourish he was invested with a Royal Order decoration, Mr. J. Von Mauer making a humorous speech. Mr. A. P. Greensfelder was elected president for the ensuing year. Other speakers were Messrs. C. P. Walbridge, president of the City Plan Commission; J. L. Messmore, president Merchants' Exchange; M. L. Holman, Captain Robert Hunt and Mr. J. W. Peters, assistant secretary of the club, who dwelt on the future development of the organization and also referred to the *Journal* of the Association of Engineering Societies, published in St. Louis. Humorous suggestions relating to the Free Bridge, the *Journal* and the membership plan were made by Messrs. Eugene H. Abadie, George Johns, O. F. Harting, Ralph Toensfeldt, W. Bryan, W. E. Rolfe and John C. Pritchard. The menu of the dinner was printed on a sheet of asbestos roofing material, and it set forth such items as "Keokuk essence d'hydraulique," "City Hall plums," "Free Bridge salad with $C_3H_4O_2$ dressing," "assorted hex. nuts," "cocktail $H_2SO_4$," and so on. Music was furnished by the Union Electric Orchestra.

# Hydroelectric Development at Tallulah Falls, Ga.—II.

**Transmission line and outdoor substations of the Georgia Railway & Power Company—Detailed description of Atlanta substation, which is the largest of its kind ever built**

IN the *Electrical World* of Dec. 20 a description of the hydroelectric development of the Georgia Railway & Power Company at Tallulah Falls, Ga., was published, and in the present issue the transmission of the electrical energy and its distribution through substations of the outdoor type are described.

### TRANSMISSION LINES

The energy from the Tallulah Falls station is transmitted over a steel tower line from Tallulah Falls to Atlanta, a distance of 90 miles; from Atlanta to Lindale, a distance of 80 miles, and also from Atlanta to Newnan, a distance of 50 miles. The main line from Atlanta to Tallulah Falls is constructed with six No. 4/0 copper conductors and two 7/16-in. seven-strand galvanized iron-ground wires, the latter being mounted on the ends of a cross-arm at the top of the towers above the cross-arms carrying the main lines. The transmission lines from Atlanta to Lindale and from Atlanta to Newnan are constructed with No. 2/0 copper, the same general type of construction as on the main line prevailing. The insulators are all of the suspension type—four-disk, two-part insulators manufactured by R. Thomas & Sons Company, of East Liverpool, Ohio, being used on the main line from Tallulah Falls to Atlanta, and insulators with five 10-in. disks, manufactured by the Ohio Brass Company, Mansfield, Ohio, on the other circuits. A telephone circuit of No. 4 special 30 per cent copper-clad wire is also strung on the towers and insulated by 15,000-volt Thomas insulators.

### TELEPHONE CIRCUIT

The telephone line is continuous from the power house to all of the substations, and at each interval of 4 miles a small telephone booth supplied with a high-voltage switch of the Burke type, which completely isolates the telephone apparatus when not in use, is provided. The switch is operated from the interior of the booth and is placed on its roof together with one-to-one insulating transformer, arrester and fuses. At the various terminals and at the Boulevard substation in Atlanta there is located a special high-frequency or tuned calling circuit for signaling the specific points desired without interfering with the magneto calling stations. The telephone line is protected by the use of horn-gaps to ground on the high-voltage side and by a new multi-cylinder type of oil-filled arrester.

A novel method of transposition is accomplished by hav-

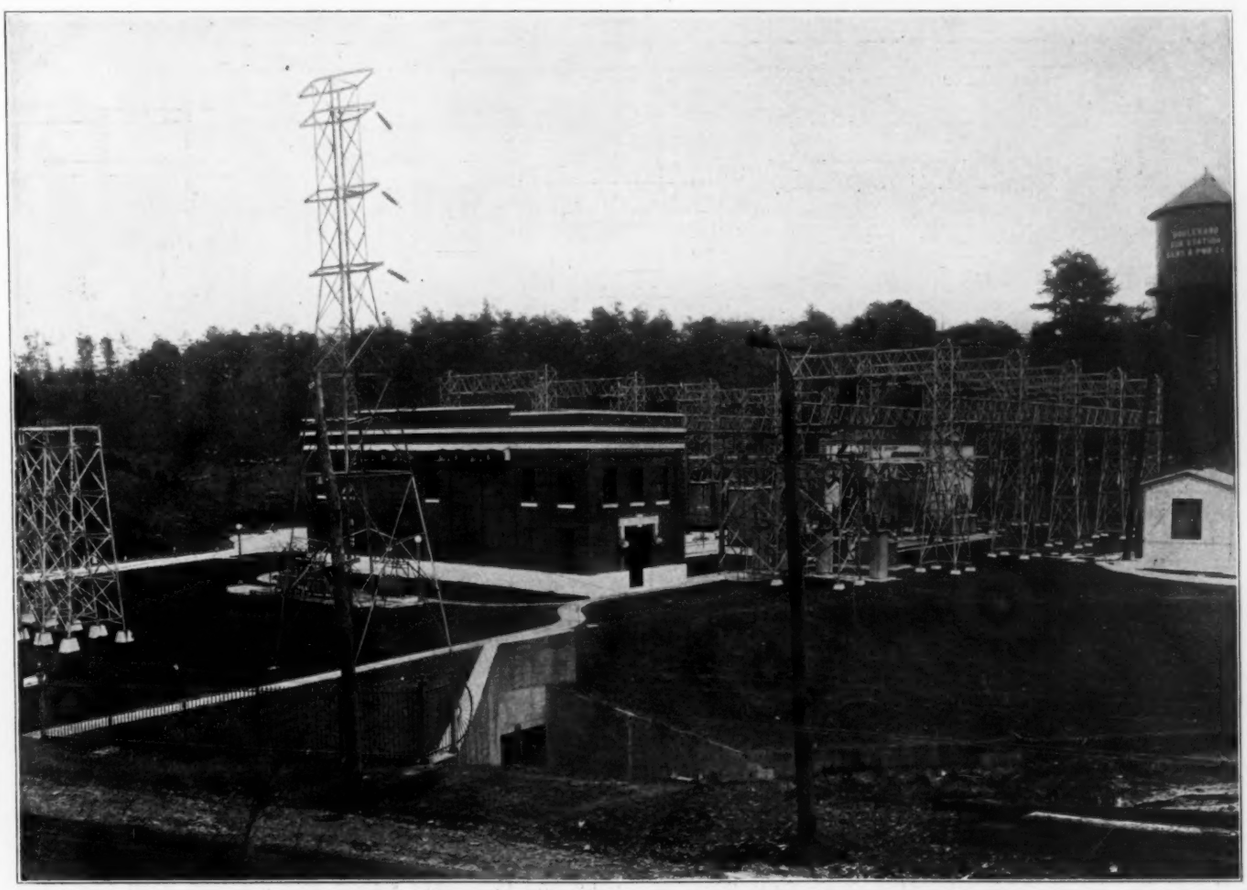

FIG. 1—BOULEVARD SUBSTATION OF THE GEORGIA RAILWAY & POWER COMPANY AT ATLANTA, GA.

ing the telephone circuits placed on insulators with pins of different heights. The wires enter the tower in a horizontal plane—one on a high pin and the other on a low pin; that of the high pin crosses diagonally to another high pin on the far side of the tower, and that on the low pin crosses to a low pin, the wires clearing each other by about 5 in. This method of making transpositions does away with the customary dead-ending of the line and connecting opposite wires with a jumper.

### Towers

The towers used on the line are spaced about seventeen to each 2 miles and were built by the American Bridge Company. Three standard types, 66 ft, 70 ft. and 80 ft. in height, are used, the first for the No. 4/0 copper circuits of the main line, the second for the No. 2/0 circuits of the lines running to Newnan and to Lindale, and the third to carry the high-tension and low-tension circuits around the 6880 lb., and those on the branch lines weigh 6680 lb. In a number of places towers 105 ft. high are used.

The towers, of which there are all told 1754, were tested for vertical, horizontal and torsional loads before shipment. All material was shipped "knocked down" and assembled at the site by the Northern Contracting Company, the general contractor for the development. The towers for the main lines were designed for a longitudinal pull of 4300 lb. at right angles to the end of any one cross-arm, a vertical load of 1500 lb. at the end of any or all cross-arms, a load of 1500 lb. pulling at the top of the towers in any direction, and a load of 10,000 lb. pulling at right angles to the line or parallel to the cross-arms; at the same time, a pull vertical to the line or at right angles to the cross-arms of 8000 lb.—that is, 4000 lb. at the ends of any single cross-arm or at one end of any two cross-arms. The towers for the branch lines were designed for a longitudinal pull of 3000

| Station | Present Rating | Future Rating | Voltages | Connection |
|---|---|---|---|---|
| Tallulah Falls | 50,000 K.V.A. | 60,000 K.V.A. | 6600-110,000 | Y |
| Gainsville | 1500 " | 12,000 " | 110,000-11,000 | Δ |
| Atlanta | 30,000 " | 60,000 " | 110,000-11,000 | Δ |
| Newnan | 3000 " | 12,000 " | 110,000-55,000<br>22,000-11,000 | Δ |
| Cartersville | 3000 " | 12,000 " | 110,000-55,000<br>22,000-11,000 | Δ |
| Lindale | 6000 " | 12,000 " | 110,000-55,000<br>22,000-11,000 | Δ |
| Gainsville City | 600 " | 1200 " | 11,000-2300 | Δ |

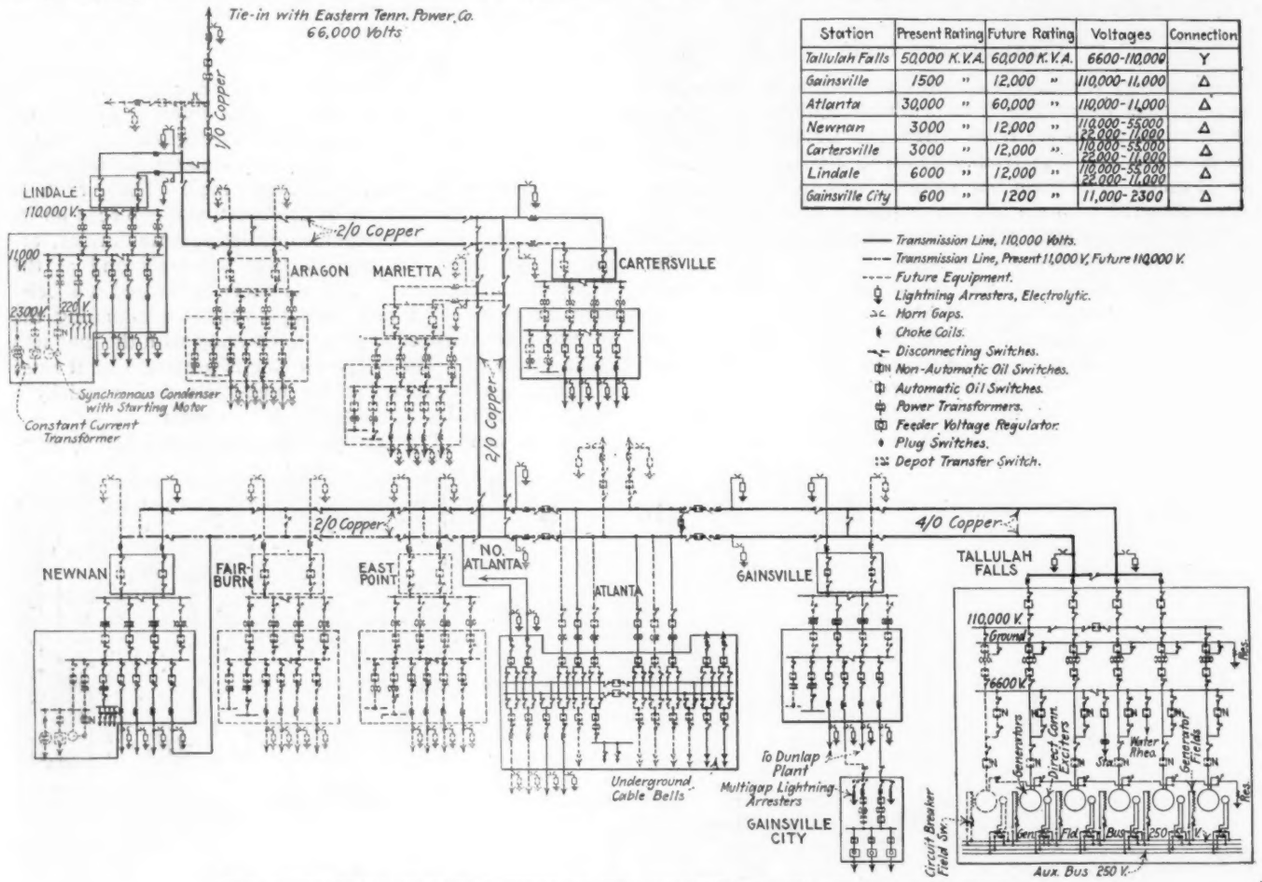


FIG. 2—DIAGRAM OF CONNECTIONS OF THE TALLULAH FALLS GENERATING SYSTEM

outer zone of the city of Atlanta. The bases of the towers, which are square, have side dimensions of 16 ft., 20 ft. and 18.5 ft. respectively.

The 110,000-volt wires are spaced on 9-ft. centers suspended vertically, one three-wire circuit on each side of the structure. The towers on the main line weigh 5554 lb., those on the branch lines weigh 4721 lb., and the special towers used around the city of Atlanta weigh approximately 8000 lb. The cross-arms are of standard channel-iron section and the tower legs are of angle-iron section. Special U bolts secure the suspension insulators to the cross-arms. The footings are made by extending the tower corner angles into the ground to a depth of about 7 ft., and footing angles are bolted to the bottom ends. In addition to the standard towers, special angle towers are used for line angles above 10 deg. The latter towers are of the same design as the standard tower, but of heavier section, and have eccentric cross-arms to take care of clearances for angle location. The strain towers on the main line weigh lb., a vertical load of 1200 lb., a load of 1200 lb. pulling in any direction at the top of the tower, a load of 8000 lb. pulling at right angles to a line, and at the same time a pull longitudinal to the line or at right angles to the cross-arms of 5000 lb. The cross-arms are proportioned for a combined load of a longitudinal pull of 3000 lb., a vertical load of 1200 lb. and a horizontal thrust of 1000 lb. at the ends. The material used in the construction is all thoroughly galvanized, and sherardized bolts were employed in assembling the various parts.

### Substations

The substations are of the semi-outdoor type, all being so designed that the high-tension switching structure forms an integral part of the transmission line. At each substation the high-tension structure was erected with the transmission towers. In this way the advantage of a sectionalizing and cross-over station was obtained from the very start, and any shut-down of the lines when it became

necessary to equip the complete substation was avoided.

Nine of these sectionalizing structures have been installed at strategic points in the lines, and five are now built as complete transformer stations with ratings varying from 1500 kva to 6000 kva.

Simplicity and symmetry have been the guiding principles of design, and a standard outdoor high-tension struc-

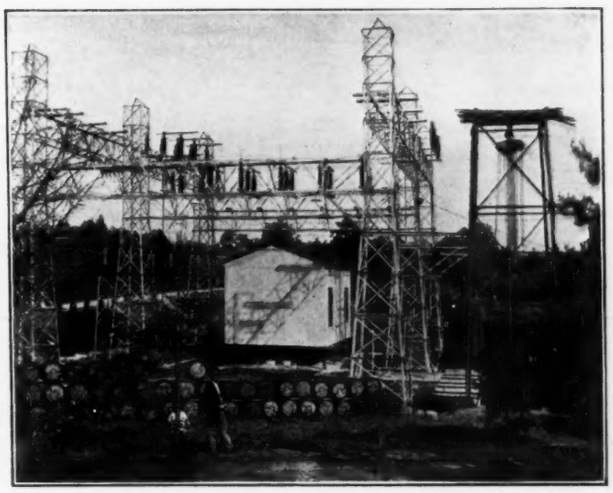

FIG. 3—OUTDOOR STATION AT NEWNAN

ture and low-tension building have been evolved to take care of a maximum ultimate rating of 12,000 kva in four banks of three 1000-kva oil-insulated, self-cooled 110,000/11,000-volt transformers. Each transformer has four 2.5 per cent taps on both the high-tension and low-tension winding, thus allowing for a 10 per cent variation in voltage either way. The sectionalizing and cross-over features are effected by the use of horn-gap disconnecting switches mounted on the lateral trusses of the latticed tower structures, all three poles of any switch being operated simultaneously by a lever and rod mechanism at the base of the

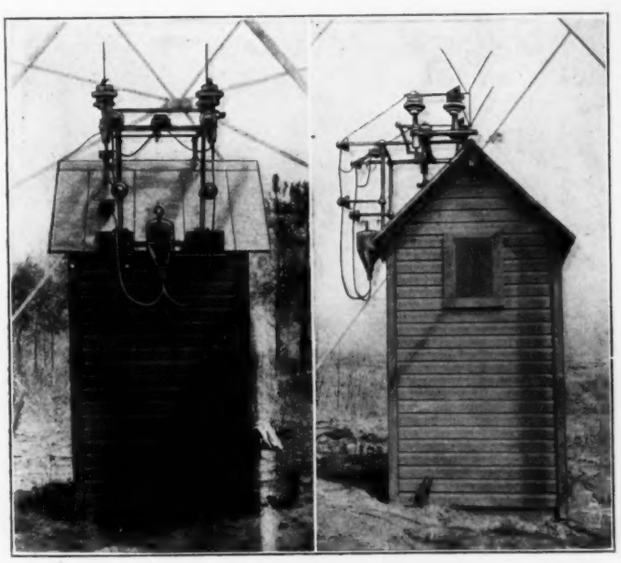

FIG. 4—TELEPHONE BOOTHS USED ON TRANSMISSION LINE

tower. It is the intention of the designers that these switches shall be used only for breaking the charging current on very light loads. In this way a very flexible arrangement is obtained without the expense and complication of high-tension oil switches at every sectionalizing or cross-over point. At each substation there are two oil switches connecting the 110,000-volt lines to the transformer bus, to which bus any bank of transformers may be connected by means of a triple-pole horn-gap disk switch. Each oil switch is protected from the weather by a sheet-steel house of simple construction, and lightning protection is afforded by an outdoor-type electrolytic arrester. Additional protection from lightning discharge is obtained by continuing the tower-line ground wires over the substation tower structures.

The standard low-tension building is of brick, built for an ultimate rating of 12,000 kva at 11,000 volts. Provision is made for four incoming three-phase lines and four outgoing three-phase feeders. All lines enter and leave the building overhead, and 11,000-volt wall entrances of standardized design have been provided on all four sides of the buildings. In addition to the above 12,000 kva, each substation has provision for a synchronous condenser, a 600-kw bank of 11,000/2300 volt transformers for local distribution and a constant-current transformer for series lighting. At each

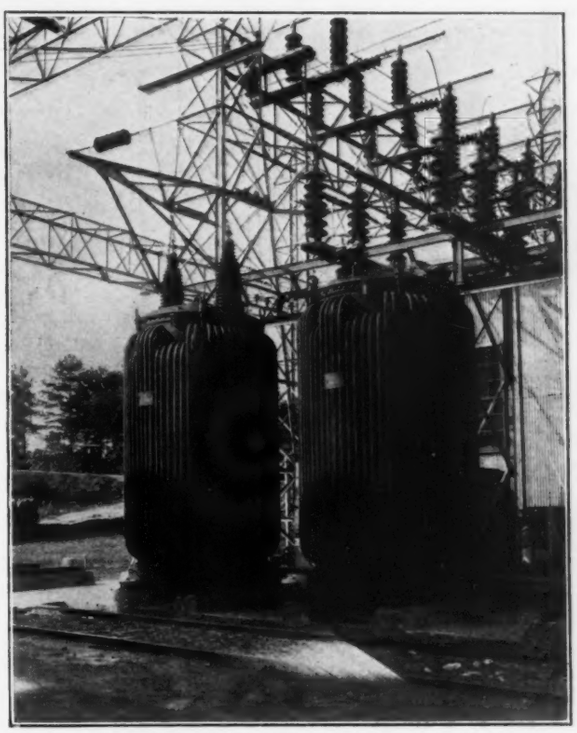

FIG. 5—OUTDOOR TRANSFORMERS AT NEWNAN STATION

substation there is also installed a hoist tower for transformer inspection and repair.

### SUBSTATION AT ATLANTA

The Atlanta substation is located on the north side of Atlanta, on Boulevard Avenue, adjacent to the city limits, and is the largest in the country. It is of the outdoor type of design, having an ultimate rating of 60,000 kw in 110,000/11,000-volt transformer equipment. The present rating is 30,000 kw, consisting of nine 3333-kva transformers. There are now two outgoing and two incoming lines connected with the station, with arrangements provided for additional outgoing or incoming lines, or a total of six 110,000-volt lines. The two present lines come from Tallulah Falls, and the two outgoing high-voltage lines lead to Newnan, and to Lindale.

The high-tension wiring is divided into two sections, known as the north high-tension busbars and south high-tension busbars, which are electrically joined together by a tie switch. These busbars are carried upon latticed steel structures of a design similar to that of the steel towers—that is, angles, channels and standard sections, bolted together. All of the high-tension wiring, as well as the trans-

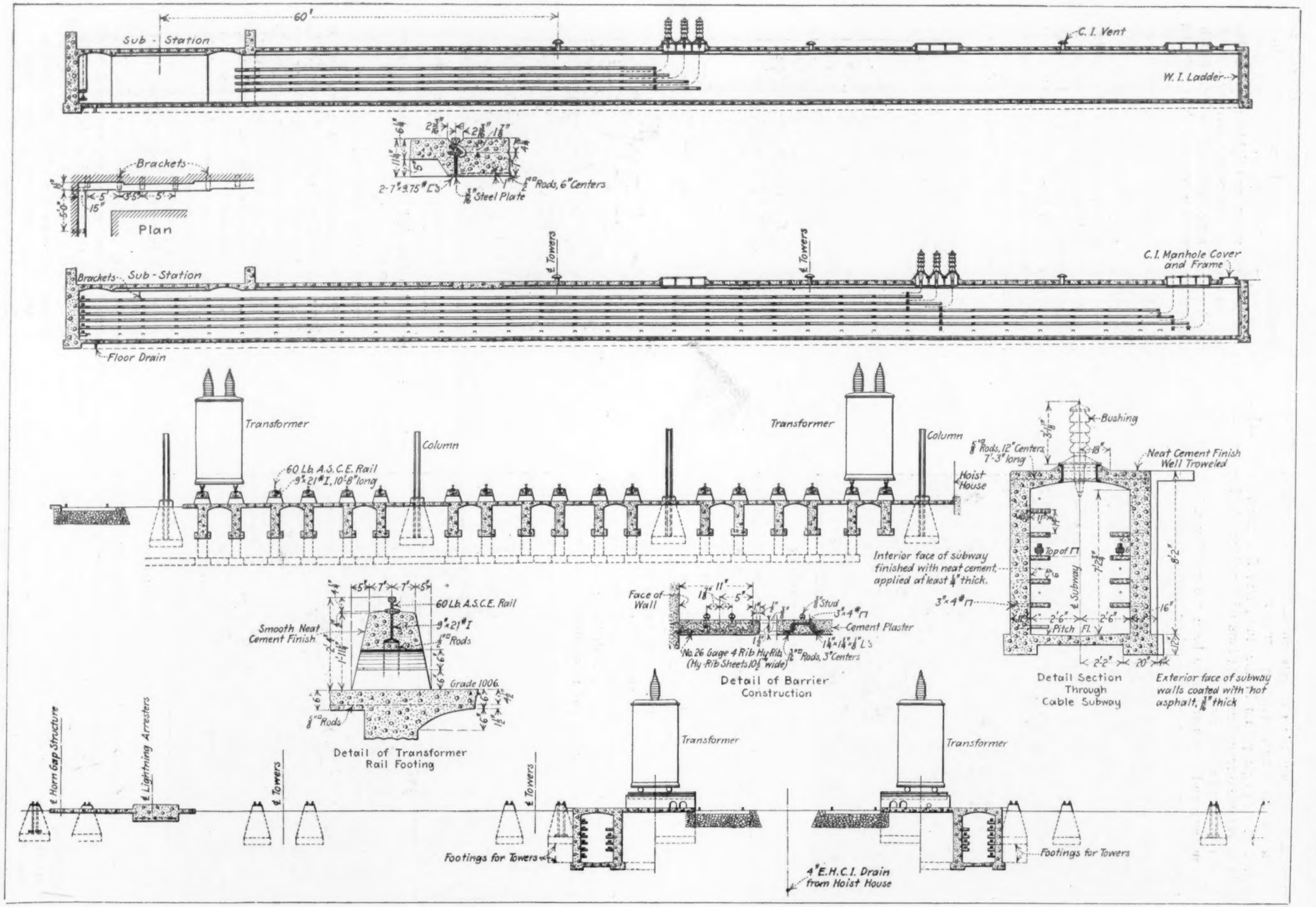


FIG. 6—DETAILS OF OUTDOOR SUBSTATION OF GEORGIA RAILWAY & POWER COMPANY AT ATLANTA

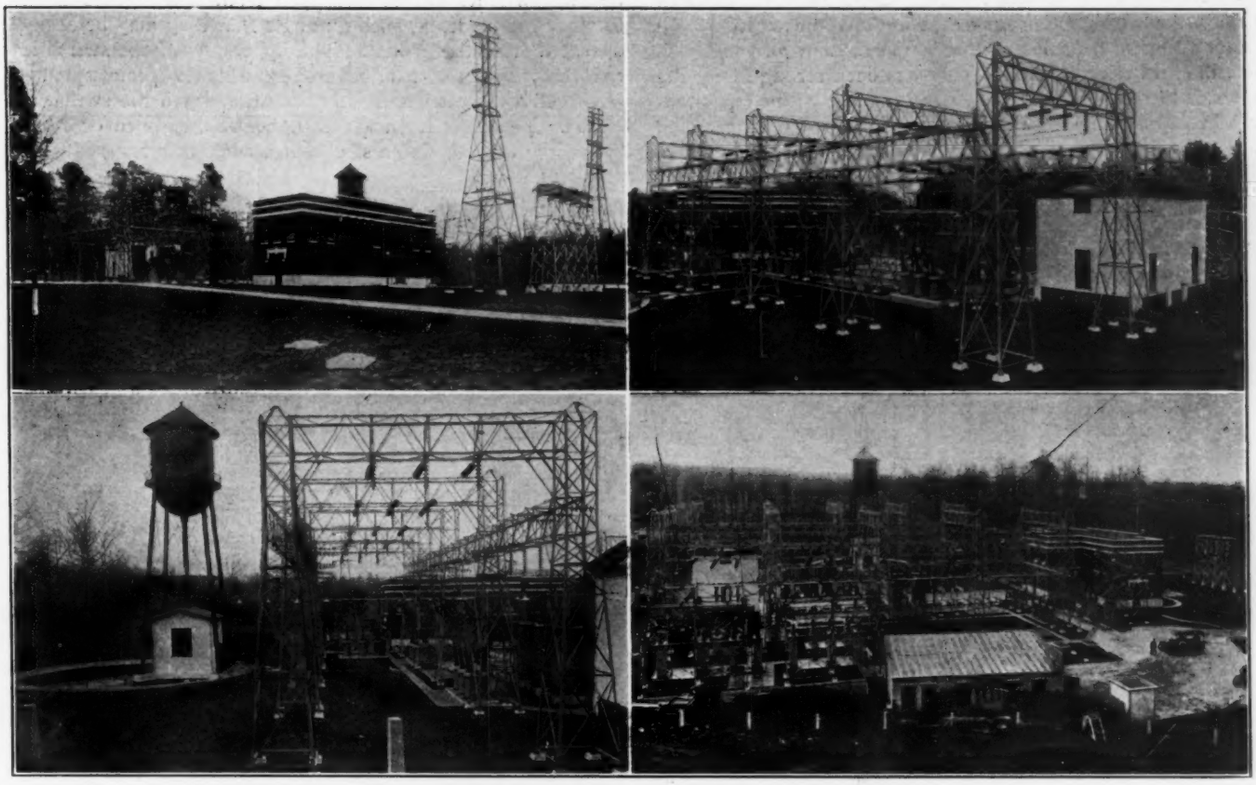

FIG. 7—OUTDOOR-TYPE SUBSTATION OF THE GEORGIA RAILWAY & POWER COMPANY AT ATLANTA

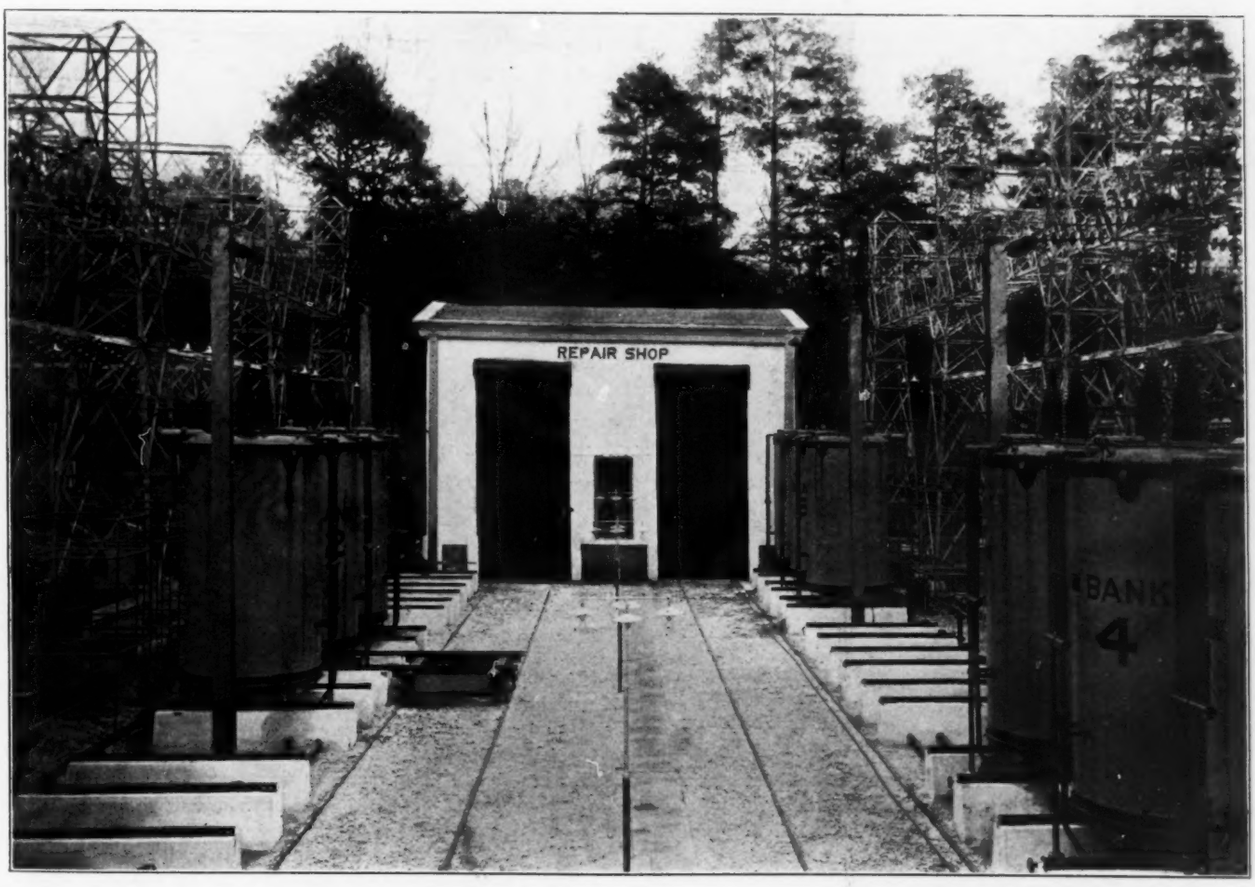


FIG. 8—ARRANGEMENTS FOR HANDLING AND REPAIRING TRANSFORMERS, ETC., AT ATLANTA SUBSTATION

formers and their circuit-breakers, are located on the outside with no protection whatever against the weather. In order to make the construction as permanent and stable as possible, the high-tension wiring has been strung along the lines of the standard catenary construction, with copper tubing busbars supported by hangers from a ½-in. copper-clad messenger, which is in turn insulated from the steel framework.

Fig. 1 shows in general the entire lay-out, consisting of high-tension frames, repair shop, water-storage tank and storage basin, low-tension or 11,000-volt building and 11,000-volt outgoing-line frame. The entire property has been graded and sodded, with concrete sidewalks and crushed-stone driveways. An ornamental picket fence has been put up on the front of the property, and one consisting of concrete posts with wire strung between them surrounds the other sides of the station.

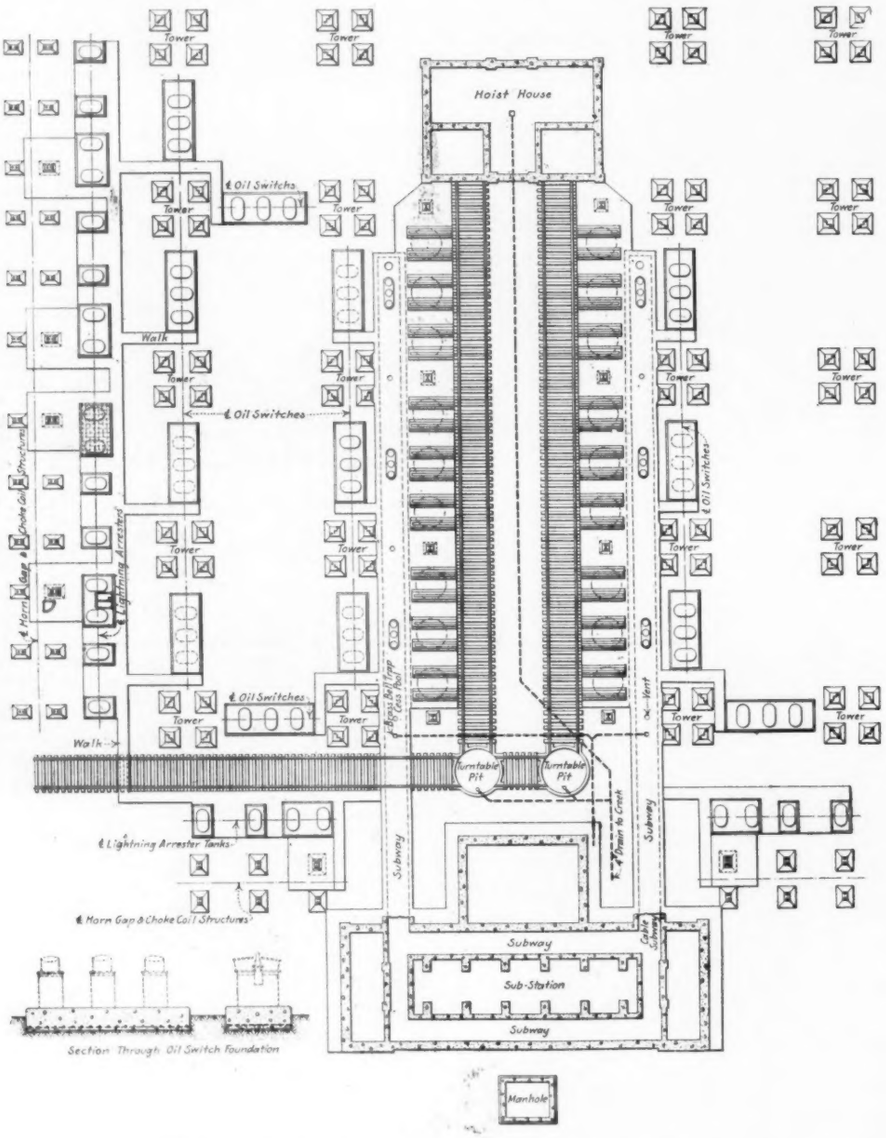


FIG. 9—PLAN OF BOULEVARD SUBSTATION AT ATLANTA

### Protection for Switch Jaws

Fig. 7 shows one side of the high-tension bus structure and the catenary arrangement of the busbars supported by the trusses. One feature of the high-tension wiring which was given special thought, and which is installed, is the disconnecting switch, which has a protection against sleet over the jaws or contact-making surfaces. These disconnecting switches are carried upon triangular trusses so as to place the blades at such an angle that they may be easily operated from the ground. The upper jaw of the switch is covered with a cast-iron covering and has a special spring-latch catch to hold the blade in position when the switch is closed. The sleet hood makes it possible to open or close the switch even during a sleet storm when it is covered with a film of ice.

All of the exterior equipment has been painted a dull marine gray with black striping. This was done to provide a more non-absorbing medium when exposed to the hot rays of the summer sun. The foundations for the ultimate equipment are already installed, so that when it becomes necessary to add to the equipment from time to time the only apparatus necessary will be the electrical equipment itself.

Lighting fixtures have been installed throughout the entire structure so that the grounds are well illuminated at night. The reflectors over each lamp are of enameled porcelain of special design, so arranged that they cannot throw the light on the high-tension wiring. It was thought that with such an arrangement defective insulators could be easily detected at night. There are also waterproof plugs at different parts of the exterior to which a portable plug can be attached in making repairs.

### ARRANGEMENT OF APPARATUS

The high-tension structure was all thoroughly galvanized before erection and the base of each rectangular column is bonded by an expanded rail bond of No. 4/0 wire to a set of grounded ring buses, which are in turn connected to each other. There are four of these ring buses, and all the apparatus is also thoroughly bonded to them.

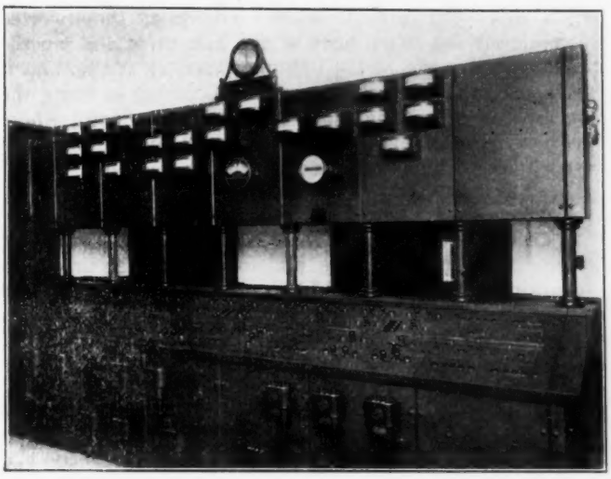

FIG. 10—BENCHBOARD AT ATLANTA SUBSTATION

Fig. 9 shows the space allotted to eighteen single-phase 110,000/11,000-volt transformers, nine of which have already been installed. Running alongside of and parallel to the transformer foundations are main transfer tracks with a suitable truck for handling the transformers. At the end of the two main transfer tracks opposite the repair house, or adjacent to the low-tension building, are two turntables, with a connecting track between them. This arrangement makes it possible to take a transformer from one bank to replace one in any other bank by means of the transfer truck. Leading from the turntables at 90 deg. to the main

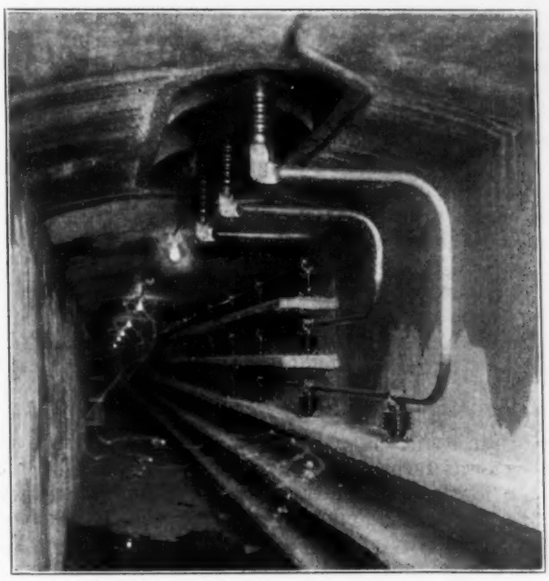

FIG. 11—ARRANGEMENT OF LEADS IN SUBWAY

tracks is the track which extends to the main roadway, so that equipment can be unloaded from wagons on to the truck and thence hauled direct to the repair shop.

The repair shop is constructed of steel, "hy-rib" and plaster with two large doors of the steel-curtain type on the front side. This building is used for making repairs to the large transformers in bad weather or when it is necessary to dissect a damaged transformer. There is installed on the interior of this building a hand-operated 10-ton crane, oil filter press, and necessary oil storage tanks, as well as a small machine shop. Having this house available for repairs obviates the use of space in the main low-tension building for this purpose, and thus does away with the dirt, grease, etc., which is necessarily present where repair work is done.

### TRANSFORMER EQUIPMENT AND CONNECTIONS

The transformers are of the water-cooled type, and suitable headers are carried along parallel to the main transfer tracks with the necessary valves for letting the water in and out of the different transformers. There are also oil mains connecting the different transformers with the filter press and oil-storage tank, so piped that the oil may be forced in either direction through the system.

The low-tension leads are carried from the rear side of the top of the transformers over to a delta bus supported on pipe framework, and from this framework down through roof entrance bushings set in iron castings of special design into the top of the tunnel, which runs parallel to the line of transformer banks. In Fig. 11, which is a view in the 7-ft. tunnel, can be noticed several of these roof entrance bushings. The leads after entering the tunnel through these roof entrance bushings are carried along concrete

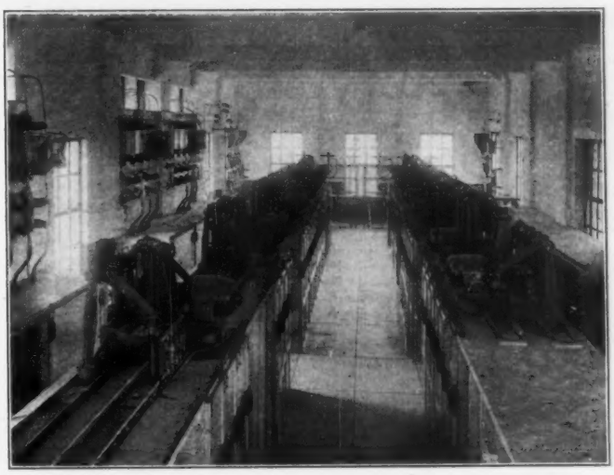

FIG. 12—SWITCH ROOM IN ATLANTA SUBSTATION

shelves, and supported by porcelain insulators, into the low-tension building where they are connected to the respective oil switches. All of these leads are made of 15/16-in. tubing so as to give the necessary mechanical strength.

### LOW-TENSION BUILDING

Each and every phase of the low-tension wiring is isolated by masonry barriers so that in case contact should occur at any one place it will involve only the one phase. Fig. 13 shows an end view of the bus structure on the first floor of the low-tension building. This structure is made of buff pressed brick and alberene stone, and the barriers at the top of transite are held in place by iron clips. The walls are corbeled out near the ceiling to carry these barriers.

Fig. 10 shows the control switchboard from which the operation of the entire station is controlled by means of pull-button switches. The high-tension mimic buses are designated on the board by brass strips, and the low-tension buses by copper strips. All of the switches are operated by a 250-volt, 40-amp-hr. storage battery, and two 10-kw motor-generator sets are used to recharge these batteries. This battery equipment was installed so that should any interruption occur to the high-voltage service the switches could still be operated.

Fig. 12 shows the second floor of the low-tension build-

ing, which contains the 11,000-volt oil switches, and shows also the location of the outgoing lines on the side walls. There is a total of fifteen 200-amp, 11,000-volt outgoing lines, nine of which are underground and six overhead, and also a station group switch. Two banks of three 10-kva, 11,000/110/220-volt and three 25-kva, 11,000/440-volt auxiliary transformers furnish the energy for lighting, pumps, motor-generator sets, etc. At each end of this room are placed the arresters of electrolytic design, which are connected to the ends of the four bus sections. The general arrangement of the switches consists of two bus sections each containing two busbars the ends of which are cross-connected through an oil switch forming a double-U bus arrangement, the feeders of which can then be switched to either section of the section bus. Facing the front of the oil switch, there is mounted on the left of the motor on each of these switches a four-pole knife switch which is used to isolate the control by cutting out the close and trip and the lamp circuits, making it impossible for an operator to throw this switch from the control board when it is intentionally cut out for repairs. All of the masonry on this

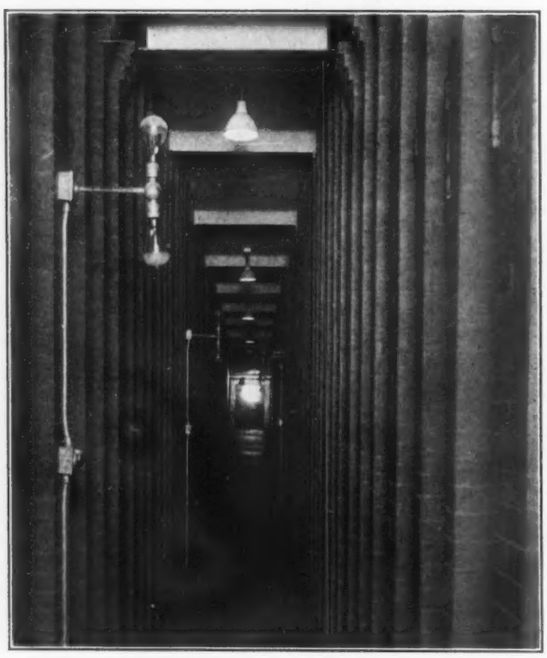

FIG. 13—BUS STRUCTURE IN ATLANTA SUBSTATION

floor is also of buff pressed brick and alberene slabs. The shunt transformers are carried in separate compartments of the same general design and construction as those of the switch structure.

The low-tension building has concrete foundations and the superstructure is of red-faced brick with white-marble trim and parapet. The roof is of concrete slab and tar and gravel construction. The window frames are of steel and are top-hinged. It is possible to view the entire outdoor equipment from the control room. This building is 81 ft. by 25.75 ft., and the control room annex 27 ft. by 18.5 ft. The first floor of the annex contains the battery room, shower baths, toilet, etc. The second floor consists of the control room itself, which contains the control board, the motor-generator sets, charging switchboard and telephone equipment, as well as a general office for the operators in dispatching the loads of the system and operating the station.

All of the incoming and outgoing high-tension lines are fitted with lightning arresters, standard horn-gaps and choke coils. The high-tension choke coils are so placed that their connection with the line is by means of a right-angle bend, while the connection through to the electrolytic tank is a straight through connection, along the direct path to and across the horns and into the arrester bushing. Between the low-tension building and dead-ending frame, as can be seen in Fig. 7, the outgoing 11,000-volt lines are fitted with an insulator. From the front of this insulator down to the lightning-arrester frame and back again to the rear of the insulator is a No. 4/0 copper wire, forming a somewhat original scheme known as the inverted hairpin. At the sharp bend at the bottom of the pin the connection is made to the lightning-arrester frame, and it is supposed that a discharge or surge coming in along the line, instead of making the sharp bend at the point where this connection is made, will go through the lightning-arrester tank. This arrangement is being tried out.

### Water Supply

In order to secure water for cooling the transformers, it was necessary to drill wells, and four have been driven to a depth of about 450 ft., and two of them piped up for use in connection with compressed air for forcing the water from the well to the concrete catch basin at the top. These catch basins are at an elevation of several feet above that of the main storage basin, and the water is allowed to feed from them into the main storage basin by gravity. In Fig. 7 can be seen the main reservoir, which is about 11 ft. deep and 61 ft. in diameter. Above this reservoir and resting on a concrete base is the 50,000-gal. elevated storage tank, about 75 ft. above the water level in the main reservoir. A vertical submerged centrifugal pump forces the water from the reservoir into the tank against the head of water there, whence it is fed by gravity through the system of cooling pipes. There is installed in the house directly under the storage tank, known as the pump house, an air compressor with a capacity of 150 cu. ft. for pumping air for the deep wells, with provision made for the installation of additional equipment similar to that now installed. An arrangement is also provided for discharging the water from the tank directly into the main reservoir without going through the piping system, or, should it be desirable to do so, the water may be discharged from the tank into waste and cooler water pumped into the tank for cooling the transformers during the hot summer months. The reservoir and tank are both provided with electrical float switches for regulating the depth of water. The pump and air compressor are supplied with energy from the three-phase, 75-kw, 440-volt bank of transformers.

Most of the electrical equipment in this station has been supplied and installed by the General Electric Company. This includes the transformers, lightning arresters, low-tension oil switches, control equipment and four of the high-tension oil switches. The latter are known as Type K-22 and are the first 110,000-volt switches for outdoor service that this company has built. Four of the high-tension breakers were furnished and installed by the Westinghouse Electric & Manufacturing Company and are of its standard GA type. The air-compressor and deep-well equipment was furnished by the Ingersoll Rand Company and is fitted with Cutler-Hammer control. The large storage tank was furnished and erected by the Chicago Bridge & Iron Company, and the local lighting, miscellaneous motor equipment and oil and water piping were installed by the Tucker Electrical Construction Company, of New York City. The grading, construction work, etc., was done by the Northern Contracting Company. The steel structures were furnished by the Alfred E. Norton Company, of Philadelphia, and some miscellaneous steel equipment by R. D. Coombs & Company, of New York. The design and construction of the station was carried out under the direction of the chief engineer, Mr. Charles O. Lenz, of 71 Broadway, New York City, for the Georgia Railway & Power Company. Mr. C. E. Bennett is the electrical engineer.

# Control Equipment for the Panama Canal Locks

**Elaborate provisions made to safeguard operation of main and intermediate gates, valves, chains, miter-forcing machines, etc.—Use of synchronous indicators on control boards**

ELECTRICAL energy for the locks, towing locomotives and lighting of the Panama Canal will be furnished by the 7500-kw, 2200-volt hydroelectric plant at Gatun and in case of emergency by the 4500-kw steam-turbine station at Miraflores, which has heretofore been used for construction purposes. A double 44,000-volt transmission line crosses the Isthmus, connecting the two power plants with Cristobal and Balboa through four transforming substations. In addition there are some thirty-six 2200/240-volt substations in the lock walls serving to supply the Gatun, Pedro Miguel and Miraflores locks with power, traction and light.

The system of connections employed throughout makes use of a double-bus, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting its circuit. In the power house and in the four 44,000/2200-volt substations the oil switches are solenoid-operated and are installed in concrete cells, above which are concrete fireproof compartments containing the two sets of buses.

### Energy Supply for Lock-Machinery Motors

Energy for the lock machinery and towing locomotives is in each case transformed from the 2200-volt system in the immediate vicinity of the place it is to be used. Each of the thirty-six transformer stations contains duplicate 200-kva, three-phase, 2200/240-volt transformers for motor service and one single-phase, 25-kva, 2200/220-110-volt transformer for lighting. These substations, although normally fed from the 2200-volt buses in the main 44,000/2200-volt substations, can also be operated directly from the power plants if necessary.

Some idea of the number and sizes of the motors to be controlled in operating the lock machinery is afforded by the accompanying table.

In general, these motors are started and controlled by contactor panels placed near them and operated from the central control house. The smaller motors, including those for the cylindrical valves and the auxiliary culvert valves, and for miter forcing, are started by being thrown directly on the line. In the case of the larger motors for miter-gate moving, and for the rising stem valves and guard valves, a starting point is provided having resistance in two legs of the three-phase circuit.

In all cases the contactors are operated from the control boards by three wires, one for forward, one for reverse and the third for the common return. For panels having a starting point the period during which the motor remains in circuit with resistance is automatically governed by a dashpot. Each individual machine may also be controlled locally in case of emergency.

From an operating standpoint the machinery is placed below the coping of the lock walls, thus affording a clear space for maneuvering ships and protecting the apparatus from the weather without the erection of numerous houses.

### Operation of Mitering Gates

The mitering gates consist of two massive leaves pivoted on the lock walls and operating independently of each other. In addition to these lock gates, at the lake and

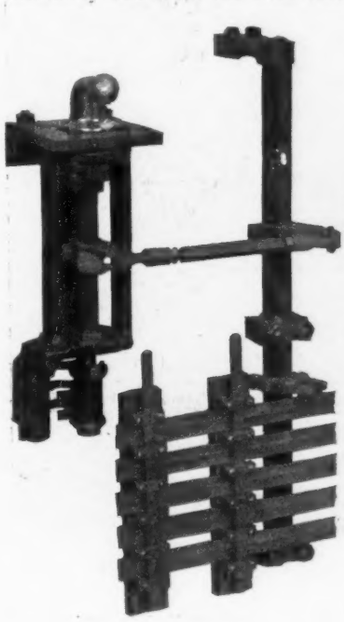

FIG. 1—CONTROL SWITCH AND INTERLOCK MECHANISM

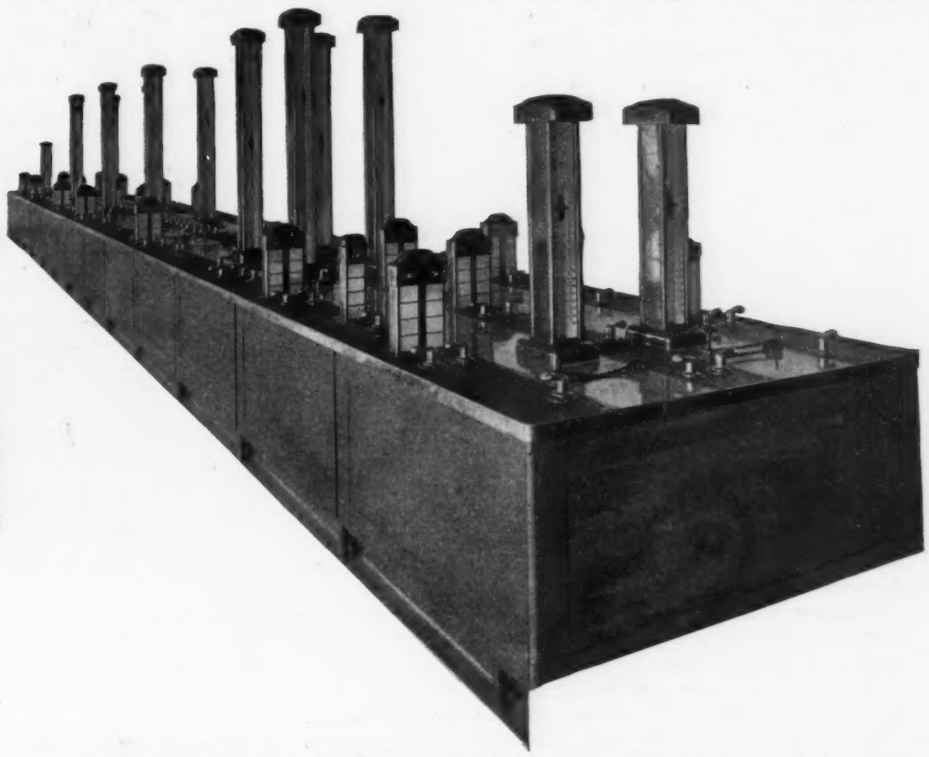

FIG. 2—CONTROL BOARD FOR MIRAFLORES LOCKS COMPLETE

ocean ends duplicate pairs of gates are provided as guard gates. Furthermore, to handle vessels of various sizes with the minimum use of water, intermediate mitering gates divide each 1000-ft. lock into two compartments. When the mitering gates are closed they are clamped in position by a "miter-forcing" machine.

On the top of all mitering gates foot-walks with hand-

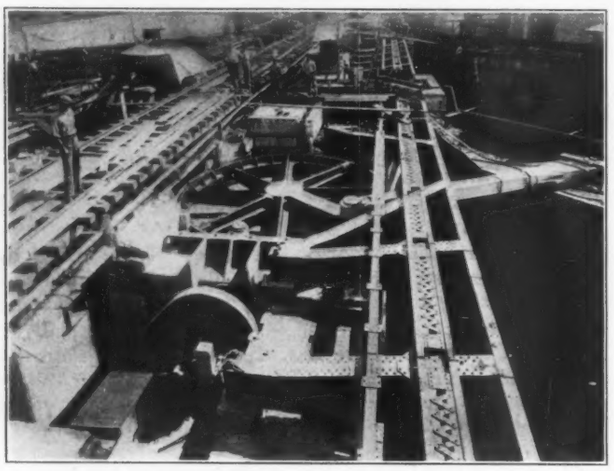

FIG. 3—MITER-GATE-MOVING MACHINERY

rails are provided. Since when the gates are opened these rails would interfere with the towing locomotives, the rails are made to be raised and lowered by a motor controlled from foot pushes on the lock walls. If the hand-rails have been left up and the gates are opened from the control

MOTORS CONTROLLING PANAMA LOCKS

| Machines | Motor Hp | NUMBER OF MOTORS | | | | Total Hp |
|---|---|---|---|---|---|---|
| | | Gatun | Pedro Miguel | Miraflores | Total | |
| Miter gate, moving, each leaf | 25 | 40 | 24 | 28 | 92 | 2,300 |
| Miter gate, miter-forcing | 7 | 20 | 12 | 14 | 46 | 322 |
| Fender chain, main pump | 70 | 16 | 16 | 16 | 48 | 3,360 |
| Fender chain, operating valve | 0.5 | 16 | 16 | 16 | 48 | 24 |
| Rising stem gate valve | 40 | 56 | 24 | 36 | 116 | 4,640 |
| Cylindrical valve | 7 | 60 | 20 | 40 | 120 | 840 |
| Guard valve | 25 | 6 | 6 | 6 | 18 | 450 |
| Auxiliary culvert valve | 7 | 4 | 4 | 4 | 12 | 84 |
| Totals | ... | 218 | 122 | 160 | 500 | 12,020 |

house, the rails will be automatically lowered and cannot be raised while the gates are open.

Chain fenders are stretched across the canal in front of all mitering gates exposed to the upper lock level. These chains are maintained taut when the gates behind are closed but are dropped clear when the gates are opened. The chains are raised and lowered by a construction similar to that used in hydraulic elevators. Should a ship approach the gates at a dangerous speed and ram into the chain, the latter will be paid out so as gradually to stop the vessel. Movement of the chain is controlled by two motors, one driving the pump supplying water under pressure and the other operating a valve which controls the direction of movement of the chain.

The filling and emptying of the locks is accomplished by three culverts, one in the middle wall and one in each side wall, the flow of water being controlled by rising stem valves. These 8-ft. by 18-ft. valves are installed in pairs, and each pair is in duplicate. Since the culvert in the middle wall must serve the locks on both sides, cylindrical valves are placed in the ten lateral culverts at each lock.

At the upper end of each lock are two auxiliary culvert valves for regulating at an intermediate height the water between the upper gate and the upper guard gate.

The flight of locks at Gatun, for instance, extends over all approximately 6200 ft. and its principal operating machines are distributed over a distance about 4000 ft. in length. The lock-control situation therefore resolved itself into centralized electrical manipulation, thus reducing the number of operators, operating expense and liability to accident. The control boards for each lock have all their switches so mechanically interlocked as to minimize, if not entirely prevent, the errors of human manipulation.

These boards are installed in control houses located on the middle walls at points which afford the best view of the locks. The control boards are themselves arranged as operating miniatures of the locks and have indicating devices which show the position of valves, lock gates, chains and water levels in the various chambers.

### Operation of Synchronous Indicators

The indicators on the Panama control boards were developed especially for this undertaking and show accurately and synchronously every movement. Both transmitter and receiver have a stationary and a rotating part. The stators consist of three-phase windings which are energized by induction from the rotors. The latter are bipolar and are energized in multiple from a 110-volt, 25-cycle, single-phase source.

Movement of the transmitter rotor produces a voltage

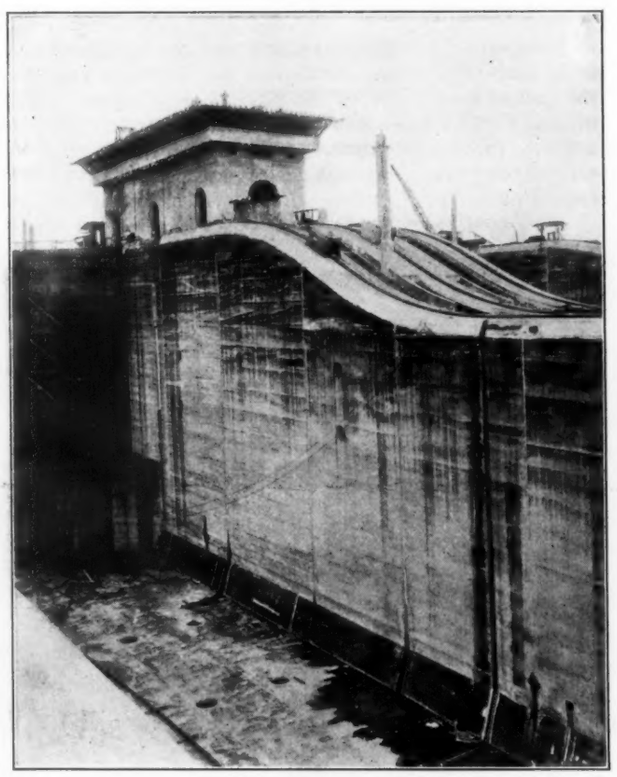

FIG. 4—CONTROL HOUSE ON GATUN LOCKS

in the stator coils which is transmitted to the receiver stator coils. Here the voltage is duplicated, but in the reverse direction. Any difference in the position of the transmitter and receiver rotors causes a difference of potential between the stator windings, with a consequent flow of current and a resultant torque moving the receiver rotor to the same relative position as that of the transmitter rotor. The re-

ceiver rotor follows closely and smoothly the movement of the transmitter, although on a scale reduced to the requirements of the control board.

In the case of the mitering gates, the indicator used comprises a pair of small aluminum leaves, which travel horizontally just above the top of the board.

For the chain fender the indicator transmitter is driven by the limit-switch shaft and the indication at the board is given by a miniature aluminum chain, which is raised and lowered like the large chain, each end operating independently. The ends of the miniature chain are fastened to semaphore arms, the angle of which also shows the position of the large chain.

As the rising stem valves are arranged in pairs, their position indicators occur in pairs also and are similar to small elevators, in which aluminum cages are used to indicate the positions of the valve gates. To make the indications more easily visible the little elevator shaft under each car is illuminated while the portion above it is dark.

### WATER-LEVEL INDICATORS

The specifications covering the water-level indicators required an accuracy within 0.1 per cent or 0.05 ft. of actual water level. Since, in the transmitters and receivers for the machines previously described the rotors turn less than 180 deg., with an inherent lag of 1.5 per cent, the same arrangement was obviously not suitable for giving the accurate water-level indications required.

It was found, however, that if the rotors were revolved ten complete revolutions the required accuracy could be obtained. But since this would make it possible for the rotors to be in synchronism every 180 deg., or in twenty different positions during the entire travel, the indicators might not indicate correctly if for some reason the transmitter rotors were turned more than one-half revolution with the excitation off. The required accuracy was finally obtained by employing two sets of transmitters and receivers, one connected to a fine index, in which the rotors make ten complete revolutions, and the other connected to a coarse index operating through less than 180 deg.

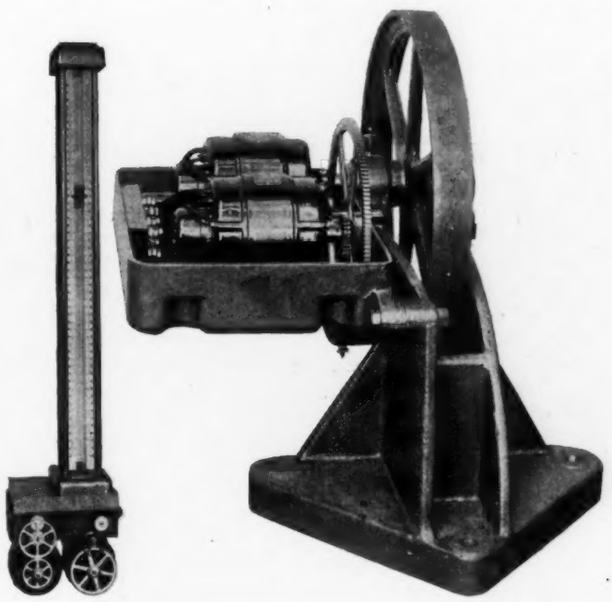

FIG. 5—RECEIVER AND TRANSMITTER OF SYNCHRONOUS WATER-LEVEL INDICATOR

The fine index is a hollow cylinder carrying a pointer, the length of the cylinder being such that when the aluminum ball representing the coarse index is within the limits of the cylinder the reading of the fine index is correct within the limits specified.

For water-level indication, wells 36 in. square, molded in the lock walls, communicate with the locks by small openings which serve to dampen surges. Each well contains a welded-steel box float, 30 in. square by 9 in. deep. A non-slipping phosphor bronze belt transmits the movement of the float to a sheave on the transmitter mechanism. Each miter-forcing machine has its open and closed positions shown by red and green lamps and a mechanical indicator.

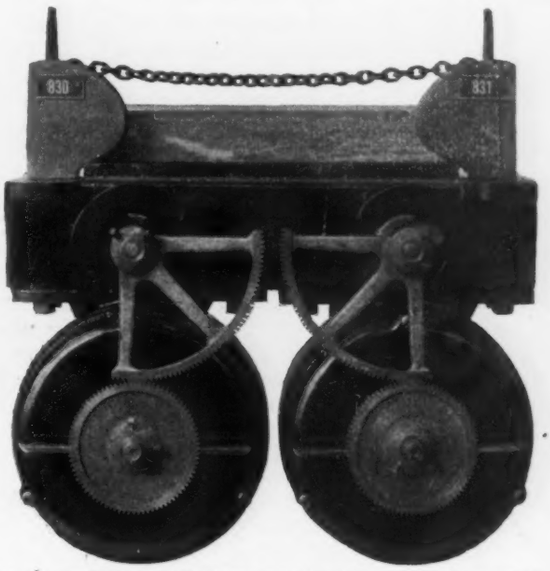


FIG. 6—RECEIVER INDICATING POSITION OF FENDER CHAINS

### CONTROL BOARDS REPRODUCE LOCKS IN MINIATURE

The control boards are of the flat-top benchboard type, 32 in. high by 54 in. wide, and were built in sections with total lengths as follows: Gatun, 64 ft.; Pedro Miguel, 36 ft.; Miraflores, 52 ft.

The side and center walls of the locks are represented by cast-iron plates and the water in the locks by blue Vermont marble slabs.

The control-switch handles are mounted above the surface of the board and operate through an angle of 90 deg. They are provided with name-plates for the "open," "closed" and "off" positions. The space immediately below the flat top is occupied by the contact fingers of the control switches and the synchronous receivers and their cable connections. The receivers, transmitters and lamps are operated at 110 volts and the control circuits at 220 volts. Both use 25-cycle alternating current.

In order to insure that the operator will maneuver the control switch handles always in a certain order, corresponding to a predetermined sequence of operation of the lock machinery, and to prevent the operator in control of one channel from interfering with the operation of the other channel, the control switches are provided with interlocks. These interlocks are arranged in two vertical racks beneath and at some distance below the control board, so that they may be inspected and oiled from a lower floor. The interlock system is made up essentially of bell-crank and rod mechanisms each connecting the shaft of a control switch to a vertical operating shaft which can or cannot move according to the relative positions of the interlocking bars and dogs. These bars and dogs are of hard, extruded brass. The special shape used keeps the dogs in line with the axis of the bars when under pressure by being engaged with another dog on a vertical bar. Every control switch uses a horizontal bar 3 ft. to 50 ft. in length.

Interlocks prevent the chain fender from being lowered until adjacent mitering gates have been opened, and also prevent the gates being opened until the chain is in the raised position. In this way the chain fender will always

be in the up position to protect the gate when the latter is closed. After the mitering gates are closed, the miter-forcing machine is operated by its control handle and locks the ends of the gates closed. This machine cannot be started, however, until the gates are closed.

The rising stem valves of the side wall next above or below a miter gate must also be closed while the miter-forcing machine is open. As the miter-forcing machine cannot be closed until after the gates, the valves either above or below the gate must remain closed until the gate itself is closed. This feature prevents the operator from creating a current of water around the gates while open.

Either pair of rising stem valves may be opened first, at the choice of the operator, an interlock becoming effective when the first valve of the second pair of duplicates is opened. This is done by a novel arrangement of equalizing levers acting against the ends of the interlock bars. There is a definite amount of lost motion which is taken up on opening the first pair of valves and thus puts the interlocks in operation on the next pair.

To illustrate this operation, the reader may consider a side-wall culvert at Gatun with its principal rising stem valves at each change of level from one lock to the next.

FIG. 7—TRANSFORMER SWITCHBOARD IN LOCK SUBSTATION

The control of these valves is interlocked so that if the valves are opened at one particular point the valves a lock-length upstream or downstream cannot be opened. Thus the operator is limited to equalizing the water between locks and cannot allow water to flow from the upper lock past the middle lock into the lower lock, which operation, if permitted, might flood the lower lock walls and the machinery chambers in them. The cylindrical valves are interlocked so that if those on one side are opened the ones on the other side are locked closed, and the opening of one switch on a side will lock the opposite ten. This prevents careless cross-filling between locks, an operation which might be combined with the regular method and produce flooding. There may be dry seasons, however, when it will be desirable to employ cross filling to economize water, so therefore the interlock is made removable by the use of a key deposited with the chief operator.

In most cases the locks are divided into two unequal parts by the intermediate mitering gates. This arrangement makes it necessary to divide the ten cylindrical valves into two groups of seven and three respectively for the long and short lengths. A selecting lever is provided for these interlocks and may be set as indicated by a name-plate on the lever to "three," "seven" or "ten" respectively. Thereafter the corresponding valves are subject to that interlock, and the others of the group of ten are locked closed if three or seven only are to be used. This arrangement permits handling small vessels without waste of water in the large chambers. If a short vessel were being passed downstream, it would first pass into the chamber having three cylindrical valves. The group selective lever would then be placed on the "three" position, which would permit the opening of three valves above the intermediate gate but would lock closed the other seven valves above it. After the vessel had been passed below the gate the handle would be reversed, releasing the lever and locking three switches. There are intermediate rising-stem valves in the side walls at each intermediate gate, but no interlocks are provided for these valves.

In case a large vessel is to be passed, the interlocks on the intermediate gates can be made ineffective by the operation of a Yale key which disconnects the central switch from the operating mechanism. Turning the key removes the interlock and permits the intermediate gates to be thrown open to obtain a 1000-ft. level. The valves can then be operated independently of these gates.

To obviate the possibility of flooding the locks when valves are in a certain position, diagonal interlocking is introduced between the rising stem valves of the side wall and those of the middle wall a lock length away. This interlocking between valves diagonally across a lock when the cylindrical valves are open is needed to prevent the flow of water from, say, the upper lock by way of a side wall culvert to the middle lock, thence by way of the middle wall culvert to the lower lock, which might allow a careless operator to flood the lower lock walls.

### Impregnation of Insulated Parts

To withstand the humid atmosphere of the Isthmus, all insulated parts, such as the coils of solenoids, relays, circuit-breakers and other apparatus, have been impregnated with non-hygroscopic compounds. All small parts are made of brass, copper, monel metal, bronze or sherardized iron or steel. Mica and treated asbestos lumber have been used largely in place of fiber or wood.

The combined weight of the centralized control boards for Gatun, Pedro Miguel and Miraflores is about 39 tons. In their construction there has been employed about 6,000,000 ft. of control leads, made up in five-conductor and eight-conductor cables; 732 indicator motors and 464 control switches.

The specifications for the entire generating, lock-controlling and distribution system for operating the Panama Canal were prepared under the supervision of Mr. Edward Schildhauer, electrical and mechanical engineer for the Canal Commission, assisted by a staff of electrical engineers including Mr. C. B. Larzelere, who was closely identified with the lock-control problems, and Mr. W. R. McCann, who was concerned with the generation and distribution of power.

The equipment described in the foregoing account was furnished by the General Electric Company.

## Electric Lighting and the Balkan War

The new electric-lighting system in Uskub, Macedonia, underwent many vicissitudes during recent months while the city was being captured and recaptured by Servians, Turks and Bulgarians. Uskub's street-lighting installation was almost finished in September of last year just before the war broke out. During the period of fighting and siege the plant remained inoperative. Finally the city was carried by the Servian army, and with the establishment of military rule the engineers of the Servian signal corps put the lighting plant into operating order. Since that time electric service has been installed in many private homes.

## Cost Figures from Brookings, S. D.

By E. M. SORENG

Brookings, S. D., a pretty city of 4000 population and the seat of the state college, is served with electricity and steam heat from a municipally operated plant which has been made a financial success as the result of intelligent and conservative management.

The plant building is a one-story brick structure, 30 ft. by 50 ft. in plan, with a wooden coal shed at the back where fuel is unloaded from wagons and wheeled into the boiler room as needed. The shed has a large storage capacity so that a considerable supply can be laid in at one time. A better price can be obtained by buying in large quantities, and advantage can be taken of any change in the market price. The boiler room contains three 100-hp hand-fired, return-tubular boilers. The smokestack is of brick 80 ft. high and 5 ft. in diameter. Two units comprise the generating equipment. One consists of a 12-in. by 36-in. 100-r.p.m. simple engine, built by the Minneapolis Steel & Machinery Company, belted to a 60-kw, 2200-volt, 60-cycle, two-phase alternator of the Stanley induction type, the exciter being belted to the shaft of the alternator. The other unit consists of a 16-in. by 36-in. engine of the same make, belted to a similar 150-kw alternator. An exhaust-steam heating system was installed in 1904 and heats the public-school buildings situated within a block of the plant, the city hall and a number of business buildings. In the daytime during cold weather not enough steam is available from the exhaust, and live steam is used to supply the deficiency.

The total cost of the present plant was $41,000, of which $28,000 is invested in the plant and steam-heating system and $13,000 in the lines, transformers and meters. The alternating-current system as first installed cost $14,000, which included the building, smokestack, two boilers, the 60-kw alternator, switchboard, some auxiliary apparatus in the plant, and some additional line construction and transformers. This money was raised from the sale of 5 per cent bonds appropriated from a sixty-thousand-dollar water-works issue.

In the last ten years $30,000 worth of bonds and warrants have been retired from the earnings of the plant, and $2,000 of the earnings has been applied to street improvements. The street lighting has not always been credited to the plant and has never been metered, so that the amount to be credited to the plant from this source can only be estimated by comparison with similar cities near by. A conservative estimate of the amount to be credited to the plant for this service is $1,500 a year, which, with interest, would amount to at least $18,000 in ten years. This makes a total revenue of the plant in ten years $50,000; or, in other words, during ten years the plant has earned $9,000 above its cost, after paying expenses.

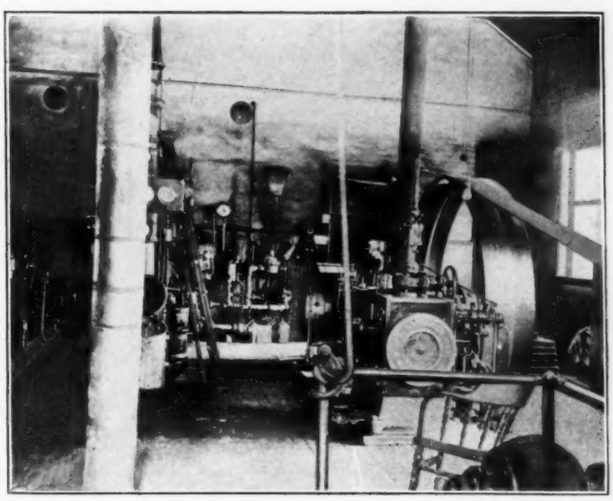

FIG. 1—ENGINE ROOM IN MUNICIPAL PLANT, BROOKINGS, S. D.

The gross revenue from lighting in 1912, exclusive of street-lamp service, was $15,600, representing about 200,000 kw-hr. at the switchboard and a load-factor of 11 per cent. The revenue from heating was $5,600, making the total revenue $21,200.

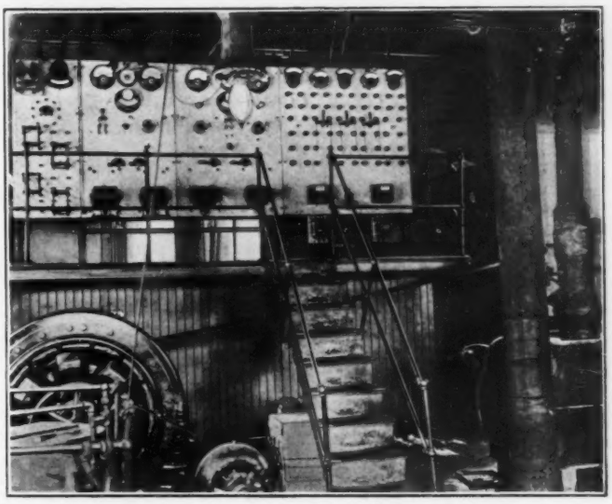

FIG. 2—SWITCHBOARD IN MUNICIPAL PLANT, BROOKINGS, S. D.

A good grade of Iowa or Illinois coal is used and in cost averages $4.50 a ton, delivered in the bins. In 1912 the cost for coal was $9,000. The city employs one superintendent of light, heat and water, most of his time being charged to the lighting and heating. Two engineers work twelve-hour shifts and one fireman works from noon to midnight. During the rest of the day the engineer on duty does his own firing. One lineman is employed continuously and part of the time has an assistant. These men also read the meters. One of the linemen spends half of his time at the pumping plant of the city water-works, so that the time of four men besides the superintendent is charged to the light and heat plant. One-third of the salary of the city auditor and his clerk is also charged to the lighting and heating plant.

The cost of electrical energy at the switchboard is 4.5 cents per kw-hr., not including fixed charges, or about 6 cents including all fixed charges. The sum of the readings of the customers' meters is 70 per cent of the reading of the station instruments, so that the total cost of energy is about 9 cents per kw-hr. to the customer, which includes the fixed charges on the distributing system. The total connected motor load is only about 50 hp, so that the revenue from this source is small and has been included with the lighting in giving the income.

The rate for lighting, up to April, 1913, has been 12.5 cents per kw-hr. and for motor service 8 cents per kw-hr., in any quantity. The present rate for lighting is 10 cents per kw-hr. up to 30 kw-hr. per month and 8 cents for all above this amount and for motors 8 cents per kw-hr. up to 100 kw-hr., and 5 cents for all above this amount. The present rate is lower than in most cities in this section of the country, the old rates having been as low as or lower than most. The municipality also operates its own central-energy telephone exchange, which has about 650 subscribers. The total cost of the system was $35,000, and the monthly revenue of the plant is $900.

For the success of the Brookings plant much credit is due to Prof. H. H. Hoy, of the electrical-engineering department of the state college, who has served on the local committee for many years.

## Handling, Sampling and Testing of Transformer Oil

By George E. Armstrong

In a large electrical distribution system, such as that of the Southern California Edison Company, transmitting energy at potentials of from 10,000 volts to 75,000 volts, much dependence must be placed on the station and substation transformers in order that service shall be uninterrupted. Modern transformer design tends toward greater dependence on oil for insulation and less on mica or other mechanically strong types of insulation. If the temperature of the transformer is controlled either by means of the water-cooled method or the forced-oil method, there is an opportunity for moisture to enter the oil and thereby decrease its value as an insulator.

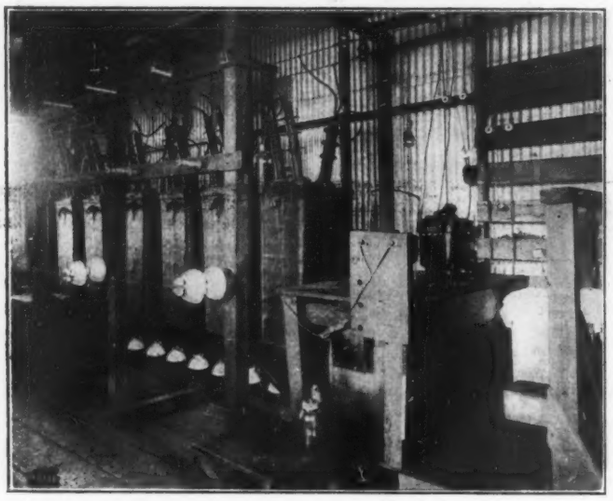

FIG. 1—SET USED IN TESTING TRANSFORMER OIL

The oil in use at the present time as a transformer cooling and insulating medium is obtained by fractional distillation of crude petroleum until it has approximately the following properties, which are averages of those standard for oil intended for use in a 60,000-volt transformer:

Specific gravity—70 deg. to 85 deg. Baumé.
Color—As light as possible for an untreated oil.
Base—Preferably a paraffin base.
Viscosity—40 seconds at 40 deg. C. (Saybolt).
Per cent of sulphur—0.
Reaction—Neutral.
Moisture—One part in 200,000 or less.

Practice has shown that transformer oil deteriorates upon use and heating. If the oil is not up to standard, it will throw down an asphalt-like deposit. Water, sulphur or other foreign matter also mixes with the oil, resulting in the lowering of the dielectric strength to such a value that the transformer is at any time liable to break down electrically. Every possible precaution should therefore be taken in handling the oil and it should be tested frequently and with extreme care in order to check any deterioration that may be starting. In varying degrees the oils obtained from the manufacturers are liable to have water dissolved in them, and therefore moisture is the most important of the foreign substances to be guarded against in the handling.

The Southern California Edison Company has experienced trouble with the oil used in its transformers in the past, and, as a result, it has recently instituted a transformer oil department which has supervision over the handling, sampling and testing of transformer oil to the end that transformer failures may be decreased. The writer is in charge of the testing of oil and, even in a few months, has been able to show that the establishment of this department was well advised because a considerable number of the transformers which make up a total rating of over 200,000 kw have been found to have defective oil.

Shipment of oil in either tank cars or steel drums introduces the possibility of moisture or other foreign substances entering the oil. Consequently the rule should be that all oil should be filtered immediately before placing it in transformers. When this is impracticable the drums should be subjected to the following treatment: They should be placed in such a position that the bunghole is lowest and a blast of hot, dry air should then be circulated within the drum until it has reached a temperature of 80 deg. C. After this temperature has been maintained five hours, the drum may be filled with the desired oil, which has been previously dried and sealed tightly. The drums should be kept on their sides in order that no moisture can collect on the heads.

Transformers should be dried as soon as they are received from the manufacturer or before being placed in service, and the best method yet evolved for doing this is by means of a blast of air which is electrically heated to a temperature of from 80 deg. C. to 85 deg. C. The air should be forced through the large valve at the bottom of the transformer and allowed to escape through the manhole in the top. After the temperature of the interior of the transformer has reached 68 deg. C. it should be held at that temperature for from twenty-four hours to ninety hours, depending on the size of the transformer. For a 100-kw transformer twenty-four hours is sufficient; for a 1500-kw transformer ninety hours is needed.

After the transformer is dried the oil to be used should be pumped into it through a filter press, care being taken that the manufacturer's instructions as to heating the paper be rigidly adhered to. It should be heated to 85 deg. C. for twenty-four hours. The Southern California Edison Company uses a General Electric portable filter having a rating of 30 gal. per minute. It is desirable—in fact, imperative—that a metal hose be used in preference to one made of rubber. A rubber hose breaks, leaks and, what is more important, is liable to contain sulphur or other impurities, which enter the oil passing through such a hose and thereby contaminate it.

The following results of introducing sulphur into oil were experimentally determined: Some pieces of commercial rubber were put into a sample of transformer oil of specific gravity 0.857, testing 48,600 volts, and left there for 18.5 hours. At the end of this period the oil was re-tested and showed an average of 12,900 volts on four tests. Further experiment showed that neither heating nor double filtration, or both, would again raise the breakdown value of the oil above 30,000 volts. The conclusion was that the quantity of sulphur in the rubber was sufficient to spoil the oil permanently and that if rubber hose is used to convey oil a similar result may be expected.

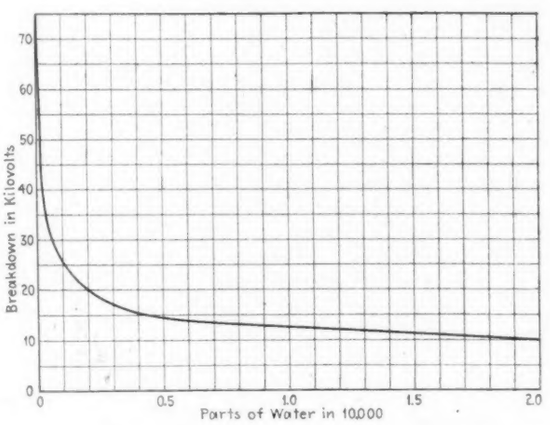


FIG. 2—CURVE SHOWING EFFECT OF WATER ON OIL

Samples of the oil should be tested frequently while it is being filtered into the transformer. When the oil is run through a filter which contains fresh filter papers it becomes filled with minute air bubbles which are invisible to the naked eye but which are discernible through a microscope. The bubbles of air remain in the oil even for from twenty-four to forty-eight hours, and during this time a

TABLE I—PROPERTIES OF FOUR SAMPLES OF OIL

| Sample | Specific Gravity | Flash Point, Deg. C. | Viscosity | Color | Breakdown, in Kv |
|---|---|---|---|---|---|
| A | 0.85 | 160 | 60 | Light amber | 42 |
| B | 0.76 | 120 | 30 | White | 37 |
| C | 0.86 | 170 | 75 | Dark brown | 44 |
| D | 0.857 | 174 | 77 | Dark amber | 40 |

sample tested will break down at a low value. Consequently, in order to obtain a true value of breakdown voltage of the oil after it has been placed in a transformer, the oil should stand at least twenty-four hours, and preferably forty-eight hours, before testing if the exigencies of the work permit. At the end of this time the oil should be tested as follows:

### TESTING TRANSFORMER OIL

Samples taken from both the top and bottom of the transformer should be tested. Top samples may be taken from the gage-glass valve, and samples from the bottom may be removed through a small sampling valve (preferably) which should be located as near to the bottom of the tank as possible and never over one-tenth of the distance from the bottom to the top. Drain valves are often placed in the very bottom and samples may be taken from it. If necessary, the large drain valve may be opened, but this is undesirable because the oil pressure forces a flow which is not easily controlled, and besides a large valve cannot be easily cleaned. The gage valve and sampling valve, or whatever may be used, should be thoroughly cleaned by wiping it with a clean dry cloth (not waste) until the attendant is confident that neither moisture nor dirt is on any exposed surface with which the oil may come in contact. If the sample is to be tested on the spot, it should be drawn directly into the test box without intermediate contact with any other container. The test box should be half filled, shaken and the oil thrown out. This should be repeated and then the test box should be filled and permitted to stand at least ten minutes before testing. Care should be taken not to insert the fingers into the oil nor to touch the inside surfaces of the test box. Precaution should also be exercised so that no water is liable to splash into the oil or dust collect on it.

If the oil is to be transported before testing, it can be drawn into one-quart Mason fruit jars which have been cleaned and had the inside glass tops removed. The sample jars may be cleaned as follows: Before using wash the jar

TABLE II—BREAKDOWN IN KILOVOLTS

| Sample | First | Second | Third | Fourth | Mean |
|---|---|---|---|---|---|
| A | 9.9 | 10.3 | 27.9 | 28.8 | 19.2 |
| B | 27.3 | 24.6 | 42.0 | 34.2 | 31.9 |
| C | 15.0 | 30.0 | 28.8 | 32.8 | 24.1 |
| D | 16.2 | 14.8 | 16.4 | 17.1 | 16.1 |

and cover with gasoline and heat them until they are too hot to hold comfortably. While still hot fill the jar half full of the oil to be tested. Then screw on the cover and shake violently. Discard the oil and fill the jar completely with fresh oil and screw the cover down tightly on a new dry jar rubber.

Samples should always be drawn directly into the sample jar without contact with any intermediate container, if possible. If any other container is used, it should receive the same preliminary treatment as the jar itself. Labels should be attached to the jars giving rating, voltages, serial number, and whether the oil is a top or bottom sample.

The standard test box used has inside dimensions of 2½ in. by 3 in. by 6 in. and will hold slightly less than one quart of oil. The center of the terminals is 1.5 in. under the surface of the oil when the box is filled. It is important that the same level be always maintained in it so that comparisons shall be accurate, because it has been found that a difference in the head causes a difference in the breakdown value, the highest head giving a correspondingly higher value. It is immaterial whether the terminals in the test box are both flat and ½ in. in diameter or one flat and one hemispherical.

A change from the usual test box was tried when a piece of apparatus consisting of two ½-in. terminals with connecting wires was made for insertion into the oil while in the sampling jar. The wires were insulated by hard-glass tubes having an outside diameter of ¾ in. and an inside diameter of 1/16 in. The apparatus was unsatisfactory because of flash-overs between the upper terminals and also because the oil tested had such a high dielectric strength as to cause an arc to start through the glass in preference to the 0.2-in. oil gap. Oil has been tested which did not break down until a tension of 76,000 volts was applied. A value of 44,600 volts was found to be the average of the tests

TABLE III—RESULTS OF FINAL EXPERIMENT

| Sample | First | Second | Third | Fourth | Mean |
|---|---|---|---|---|---|
| A | 30.8 | 31.6 | 31.6 | 28.0 | 30.5 |
| B | 28.0 | 30.8 | 40.8 | 40.8 | 34.9 |
| C | 15.2 | 17.0 | 15.6 | 15.4 | 15.7 |
| D | 13.2 | 13.2 | 13.4 | 14.2 | 13.5 |

made on fifty samples of oil taken at random from 400 samples out of 60,000-volt transformers.

Experiment has shown that the size of the testing set does not affect the breakdown point of the oil. A testing set, half of which is shown in the illustration, was used and a small set having two shunt transformers of a combined rating of 400 watts was experimented with. Comparisons of breakdowns agree closely for values above 15,000 volts, below which the larger set gave the lower values. Mean results follow:

| | VOLTS | | | | |
|---|---|---|---|---|---|
| 10-kw set..... | 38,500 | 21,600 | 25,600 | 24,900 | 8,500 |
| 400-watt set..... | 38,100 | 21,900 | 22,400 | 32,700 | 11,300 |

Therefore it will be seen that test results are comparable even when made by different test sets, and different test boxes having terminals of different kinds, provided the gaps are constant.

When samples are collected in jars to be tested, a small quantity of the oil should be poured over the gap to rinse the box, and then discarded. The gap is adjusted by a 0.2-in. gage, the box filled and the voltage applied until at least three successive check tests are made on each sample. The oil may or may not be stirred between tests, since it has been found that an action takes place which causes the oil to circulate, because of the impressed emf.

After using the test box it should be completely filled with oil and covered with glass in order to keep out moisture and dust. The face of the terminals should be dressed at least once a week if tests are made every day in order that practically parallel faces shall be presented. The quart sample jars should be left full of good oil and the covers screwed down. Nothing except transformer oil should ever be put into these jars.

Extensive experiments were made to determine the effect

of water on oil so that a curve could be drawn comparing the quantity of water in a given amount of oil and breakdown values. An experiment was also made in order to determine to what extent various makes and grades of oil deteriorate when placed in contact with water. The value of the experiment lay in the fact that the conditions were quite similar to those when a small leak develops in the cooling coil of a transformer and the water is precipitated in minute drops through the oil and finally collects in the bottom. Four 1-gal. samples, known as A, B, C and D, were selected which had the properties given in Table I.

Each of these samples was subjected to the following treatment: One pint of water and one pint of oil were shaken thoroughly together in a gallon bottle until the mixture was milky-white. The bottle was then filled with the same oil and the whole was placed in a quiet place where it would remain undisturbed. Tests were made fifty-six days later on samples which were siphoned from the top part of the gallon bottle from a point at least 7 in. above the surface of the water.

Additional water was then shaken up with the remainder of the samples and allowed to stand for 160 days in order to permit all the water which was not held in solution to precipitate. Table III gives the final results of this experiment.

Thus it is seen that somewhat similar oils are affected to quite wide degrees when in contact with water and that oil can be, and is, produced which is better suited for transformer insulation than that required by some of the present manufacturers.

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## A Triumph in Central-Station Diplomacy

Here is an account of how an impoverished plant in the hands of a receiver was put on its feet financially with a public demand for a 25 per cent increase in rates. The central station in question supplied electricity to a small town in the East with a winter population of 4500. It was taken from the receiver and gained a new lease of life under the management of a small syndicate of public-utility operators which saw in the property an opportunity to develop business along modern lines. The task was accomplished after a thorough study of the local conditions had been made and after the consuming public had been thoroughly canvassed as to the needs of the situation.

The method employed in achieving these results involved personal conferences with consumers. Good use was also made of letters sent to every user of service setting forth the exact status of affairs and the need of higher rates. In the following paragraphs are given the essential features of the statement addressed to each consumer, which resulted in a four to one vote by the company's customers that the price of electricity be raised from 16 to 20 cents per kw-hr., in order that the new concern might take up the rehabilitation of the property.

### Text of Letter to Consumers

By way of introduction in its letter, the syndicate explained to each consumer that it had been invited to advance the funds necessary to put the lighting company in a condition to give satisfactory and reliable service and also the money necessary to enlarge the electric plant and distribution system so that the town might have a thoroughly modern installation serving the entire community. The statement then proceeded in part as follows:

"As you doubtless know, the company is in financial difficulties and is in the hands of a receiver. We are advised that the service in the past has been far from satisfactory. We have had the plant and distribution lines of the company examined by competent engineers, who advise us that the plant is in bad condition and unable to give satisfactory service. It is impossible to start one of the oil engines, and the other oil engine has to be constantly repaired to keep it in an operating condition. This condition, we are told, has resulted in frequent shut-downs which have caused the street, house and store lamps to go out, thus destroying the usefulness of the service and causing great inconvenience and some danger. Further than this, in some cases the distribution lines of the company are so small that they will not carry electricity enough to serve all customers, causing lamps to grow dim and power to diminish when more than a certain number of customers are using electricity at the same time.

### Poor Service Result of Insufficient Return

"The deplorable condition of the plant and distribution lines of the company and of the service furnished by it is not due necessarily to lack of desire on the part of the present owners of that property to give satisfactory service and keep it up to modern standards of efficiency. The financial and operating difficulties of the company are primarily due to the fact that it has not been receiving a living price for its electricity from the consumers whom it serves. The insistent bills such as wages, fuel and taxes have, of course, been paid, but because of the low prices received there was not money enough to keep the lines and machinery in repair and little by little the service got into its present unsatisfactory and unreliable condition. It has simply been a case of selling service at less than cost.

"It will be a difficult and expensive task to put the electric lighting property in Blanktown on a basis which can satisfy the proper demands of the consumers. A large amount of engineering must be done; new machinery must be installed; the lines must be enlarged and extended. Since we have been invited to undertake to supply the money for this work, we have had the entire situation carefully examined by our engineers, and we are of the opinion that it will not be possible for us to do anything in the matter unless on a basis of hearty co-operation with the people of Blanktown. In our opinion, the only plan which can succeed is a co-operative one.

### Conditions Necessary to Rehabilitation

"We will form the Blank Electric Light Company and pay into it in cash $35,000, which will be necessary (1) to buy and install a modern steam and electric plant; (2) to buy the present distribution system and old plant of the Blank Company; (3) to make the necessary extensions and improvements on the distribution system, and (4) to furnish the company with proper working capital so that it will not have to place a mortgage on its property or become involved in debt as did the Blank Company. We agree that this $35,000 will be used for these purposes if this plan is adopted.

"This is the smallest amount of money that our engineers figure will accomplish these four things which are absolutely necessary if the Blank Electric Light Company is to become one of the useful institutions of Blanktown. We will also agree that one or two Blanktown men shall be added to the board of directors of the company, so that Blanktown shall be properly represented at all business meetings of the company. We will also agree that arrangements shall be made with local contractors so that they can wire the houses and other buildings of those desiring electricity at low prices and upon convenient terms. The foregoing offer is conditioned upon the willingness of the consumers of electricity in Blanktown to co-operate with us and pay the rates necessary to allow the company to meet its obligations, including labor and all operating expenses, interest, taxes and cost of maintenance and depreciation.

"Our engineers estimate that to give the town a reliable electric lighting service a net rate of 20 cents per kw-hr. will have to be established as the price for energy for lighting, and $20 per annum for each street light of the same candle-power as is now being used and burning the same number of hours and nights each year as at the pres-

ent time. The good service that these prices will make possible will save you the expense and inconvenience of maintaining and using kerosene lamps and other emergency lighting outfits.

CO-OPERATIVE FEATURES OF THE PLAN

"As this plan that we propose is on a co-operative basis, it will be agreed that at the close of the fiscal year, June 30, 1914, earnings and expenditures for the year will be computed, and if there is an amount left after deducting the cost of operation, maintenance, taxes and a fair return on the value of the plant and the proper amount for depreciation, the balance will be credited to the customers on their monthly bills pro rata. The same plan will be followed each year until it is found that the present rates can again be safely established. In this way the company will absolutely insure to the users of electricity the return of every cent beyond the necessary cost of doing the business. The prices mentioned above are the lowest which can possibly be adopted and still enable the company to fulfil its necessary obligations to the public, to itself and to the money invested in its property.

"We are willing to become interested in the property only on the basis that the people of Blanktown want us to do so, and provided we can start doing business on a co-operative basis as suggested above or on some similar basis if a better one can be devised. We should be pleased to have your suggestions in the matter. By active co-operation, the business of the company should be increased, enabling future reductions in rates. If it is your desire to secure reliable service at fair prices, we are ready to do our best to give it to you. We ask that you indicate upon the inclosed slip whether or not you want us to invest our money and our efforts to improve the electric-light plant and system in your town. Please return this slip filled in as requested not later than Aug. 20, 1913. Our Mr. R and Mr. T are planning to be in Blanktown on Aug. 18 and 19 and will be pleased to meet you to answer any questions you may wish to ask if you will return the inclosed slip."

APPENDIX DEFINING TERMS USED

Accompanying the foregoing letter there was inclosed an appendix sheet giving definitions of the terms "operating expense," "reasonable rate of interest," "maintenance" and "depreciation," with the following discussion:

"It is not as difficult now as formerly to estimate just what the obligations of a lighting company are. Recently the United States Supreme Court and the Court of Appeals in the State of New York, as well as other important courts, have passed upon these questions. Briefly these obligations are as follows:

"First, the actual cost of operating the plant and producing and distributing the electricity, including the expense of management and the cost of maintaining or keeping in repair the producing plant and distribution system, must be met.

"Second, an amount of money must be set aside each year which will be sufficient ultimately to replace the various parts of the plant and distribution system as they wear out. With the best of care, all machinery and apparatus ultimately become useless, and the company must be gradually building up a fund to replace this machinery and apparatus as it wears out, otherwise it will be in financial and operating difficulties in the course of a few years when the machinery and apparatus start to become useless. There should be set aside each year for the purpose of replacing the property not less than 7 per cent of the value of the property. This percentage is based on long experience of manufacturing and electrical engineers from an observation of the actual workings of electric lighting plants. Some parts of the property will become practically useless in a much shorter length of time than other parts, but at the end of approximately fifteen years practically all of it will be useless or unreliable. Those parts which have not been replaced during the fifteen years will have to be replaced by that time. If they are not so replaced, the efficiency and service of the company will be handicapped.

"And, third, a fair return on the value of the property must be made to the owners who have put their money into the business and who take the business risk of the investment. It is impossible to make improvements and extensions if the money with which to make them cannot be secured, and the persons who have this money to invest or loan will not do it unless they get what is generally considered a fair return. The question as to what is a fair return on money invested in a public lighting business has been considered by the courts we have referred to above. In New York City, where there is held to be the smallest risk of any place in the country to those having their capital invested in the manufacture and distribution of gas or electricity, the fair rate is considered to be 6 per cent per annum upon the money actually invested or upon the value of the property, which, as the court states, is the replacement value of the property plus a reasonable allowance for the cost of the necessary engineering and incidentals. In Kings County, a part of New York City, a 7.5 per cent return on the value of the property is a fair return. In the smaller municipalities in Massachusetts a return of 8 to 10 per cent is necessary to take care of these business risks."

## The Science and Art of the Pupin Coil

Dr. Michael I. Pupin, of Columbia University, addressed the New York Electrical Society, Dec. 18, on the topic "The Science and Art of the Pupin Coil." In the course of his interesting lecture Dr. Pupin made striking use of mechanical analogies to explain some of the phenomena of telephonic transmission.

To transmit mechanically a given amount of energy to a distant point, he explained, one has the choice of using a small mass at high velocity or a large mass at low velocity. When transmission takes place through a frictional medium the high-velocity small mass dissipates much of its energy in the intervening medium. Electrically as well as mechanically, therefore, it is advantageous to employ low-velocity heavy masses and, similarly, electric circuits having large magnetic mass (inductance). Nature has failed to provide a material affording the required large inductance per unit of length, but the desired result can be obtained by inserting inductance coils at intervals in the line, provided that these intervals are well within the wave-length employed. The result is similar to that of loading a cord with small lead weights; the cord will transmit transverse waves of large amplitude much as if it were itself of large and uniformly distributed mass.

In the practical loading of lines the coils are now inserted about eight to the wave-length, although accurate spacing need not be preserved. To prevent "cross-talk" where groups of loading coils are installed together in constricted space, the toroidal or ring-shaped core was developed. Such coils are devoid of leakage flux. Eddy currents, which add to the apparent ohmic resistance of the windings, are minimized by building the cores of insulated laminations or fine iron wires. Iron of rather low permeability is preferably used, the core being worked at a very low density involving only the lowest portion of the permeability curve below the first knee. Great skill and experience are required in the design and construction of the coils themselves, although the matter of installing them in the line requires little care. The Pupin coils are built in America by the Western Electric Company and in Germany by Siemens & Halske. Use of the loading coils on aerial lines has incidentally pointed out the need of better insulation for the higher voltages employed on loaded lines.

# Central Station Management

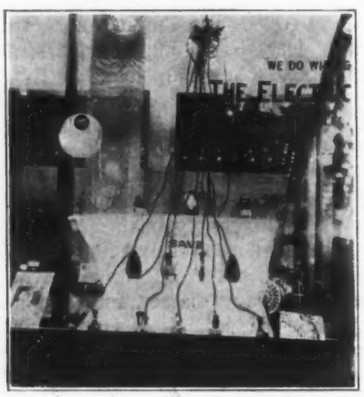
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Performance of Battery-Driven Street Cars

In New York City one of the street-railway companies is now operating 120 battery-propelled cars, each with a seating capacity of twenty-eight persons. The average travel of these cars is between 60 miles and 70 miles per day, with an operating cost approximating 7 cents per mile. This charge includes battery maintenance, oil, grease and mechanical repairs, but not the motorman's or conductor's wages. The average daily consumption of each car is 35 kw-hr.

## Inside Information in Iron Displays

A window display recently exhibited in the electric shop of the Consolidated Gas & Electric Company, Youngstown, Ohio, attracted considerable attention because it imparted to the passing public a bit of information on electric-iron construction which had not previously been put before it in such an attractive manner. As shown in the illustration, several electric irons were arranged in the window of the



ELECTRIC-IRON DISPLAY, YOUNGSTOWN, OHIO

shop. The sole of the center iron of the upper tier was removed, baring to view the heating element incased in its transparent mica covering. A small electric lamp in the body of the iron lighted the heating element in bold relief, revealing the details of the iron's construction. The display told in a simple way something which practically every user was interested in knowing, and it was only through the offices of a policeman, who kept the pedestrians moving, that the accompanying night picture was made possible.

## Electricity in a Big Louisville Garage

The Southern Motors Company, of Louisville, Ky., which recently opened a garage and service station, said to be the largest in the South, is using the central-station service of the Louisville Gas & Electric Company. The automobile company acts as agent for electric pleasure cars, charges electric vehicles, and builds and remodels electric batteries. Every gasoline car it sells is equipped with electric lighting and nearly every one is fitted with an electric starter. While the company's new building was in course of erection, electric lighting was used to facilitate construction and electric hoists were used for handling the material. Electric motors operated the concrete mixers and provided power for various other purposes. The garage lighting comprises 200 tungsten lamps, many of them 100-watt capacity. Six large motors are installed for operating elevators, cleaning machinery, charging batteries, etc.

## New-Business Outlay and Return

One progressive central station makes a policy of appropriating about 2.5 per cent of its gross revenue in soliciting and advertising. In getting new business it is sometimes found to be necessary to spend about 25 cents for each $1 of increased revenue. On this basis the central station would be warranted in spending $45 to obtain an electric-vehicle customer. And when the desirable nature of the load receives full consideration and the general improvement in commercial and civic conditions is taken into account, the outlay of as much as $60 is often justified on each commercial truck and $25 on each pleasure vehicle sold. In connection with this topic it has been suggested that central-station salesmen should furnish the makers of electric vehicles with "tips" concerning prospective customers and that the salesmen be credited with sales of such electric cars on the same basis as that on which they are credited for the sale of other motor-driven apparatus.

## Obtaining a Pumping Load in Irrigated Territory

A speaker at the recent Glenwood Springs convention of the Colorado Electric Light, Power & Railway Association pointed out that the central-station problem of developing a pumping-plant territory is one meriting much attention, as the load is extremely desirable. First, the cost of the line to serve the territory and the minimum sum returnable from the investment must be determined. A thorough personal canvass of farmers in the territory should be made. The prospective customer will raise innumerable practical questions, and the central-station man must be prepared to answer these questions in language intelligible to the layman. The electrical man must not talk "above" the farmer's comprehension, but should use such terms as "horse-power" and "second-feet," the "rate per acre-foot," etc.

Frequently it is rather difficult to explain to the average farmer why he should pay $10 a month for a 10-hp motor whether he uses it or not, and in addition a certain rate per kilowatt-hour for energy consumed. Assuming that the cost of the line is $750 a mile and that this cost must be returned in gross receipts in three years' time, the minimum gross earnings must be at the rate of $250 a mile. It is reasonable to suppose that at least two pumping plants can be secured per mile of line and that they will care for at least 320 acres. Thus these 320 acres should guarantee a minimum return on the investment of $250 a year.

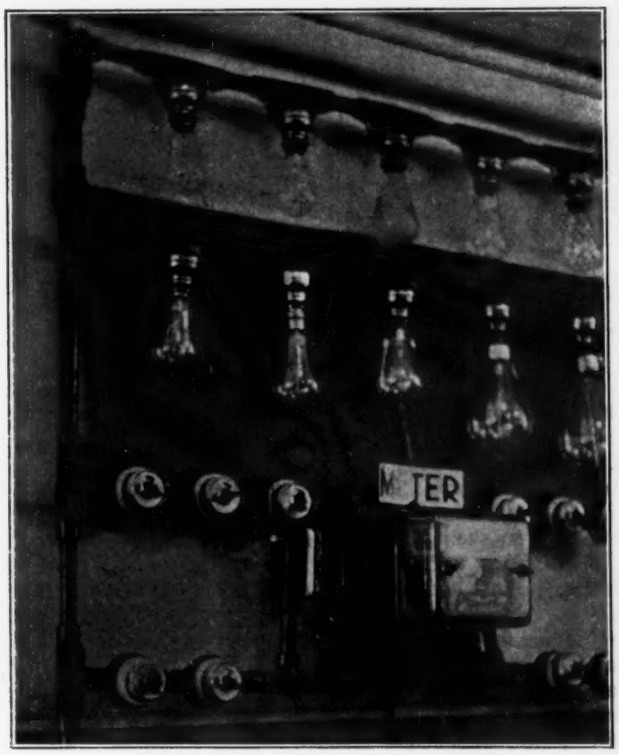
The speaker told of making fourteen contracts this year based on a minimum charge of 75 cents an acre of irrigable land, with a flat rate for energy consumed of 4 cents per kw-hr. At this rate the minimum return would be $240 per annum. In some seasons this minimum would be all that would be returned. But in an ordinary year, when

the usual amount of irrigating is done, the return would be approximately $450 from the 320 acres, this figure being based on a 4-cent rate and a 16-ft. lift, making the average return $1.40 an acre.

By the other plan there would be a fixed charge of $20 a month on the two 10-hp plants for six months, and with a further 3-cent rate the probable return in an average year would be $456. This is $6 more than by the first plan. However, in a year of heavy rainfall when little or no irrigation is done the income to the central station would be little more than the fixed charge of $120, or about $120 less than the receipts under the second plan.

## A Simple Lamp Display Frame

In the offices of the Worcester (Mass.) Electric Light Company the simple lamp and meter display frame shown in the accompanying photograph is frequently utilized in connection with new lighting customers or in advising those




LAMP AND METER DISPLAY FRAME

already on the lines regarding the selection of incandescent lamps. The frame is built of ordinary ¾-in. wrought-iron pipe, containing four rows of lamps and switches, with conduit wiring and a 10-in. by 10-in. meter slab at the front by which the usual demonstrations of comparative energy consumption can be made. The frame is 6 ft. 6 in. high and 3 ft. 5 in. wide and carries a 10-in. by 42-in. shelf for the temporary connection of portable energy-consuming devices of small size. The absence of leading-in wires at the lamps is a feature which is effective in convincing prospective customers of the compactness and safety of electrical service, many frames of this sort being objectionable on account of the failure of the demonstrating company to conceal its wiring. An additional feature not ordinarily found is a set of white, yellow and green roller curtains at the rear of the frame, by which the effect of different sizes and types of lamps against backgrounds of varying color can be studied. Near the frame the company has posted a sign advertising in well-chosen sentences the extended use of electricity.

## Motor-Driven Blowers in Automobile-Engine Factory

Dodge Brothers, of Detroit, Mich., manufacturers of the Ford automobile engines, are using motor-driven centrifugal compressors to supply air for their forge furnaces, annealing furnaces and cupolas. Formerly positive-pressure blowers geared to motors were used, but these have since been replaced by combination compressor motor sets.

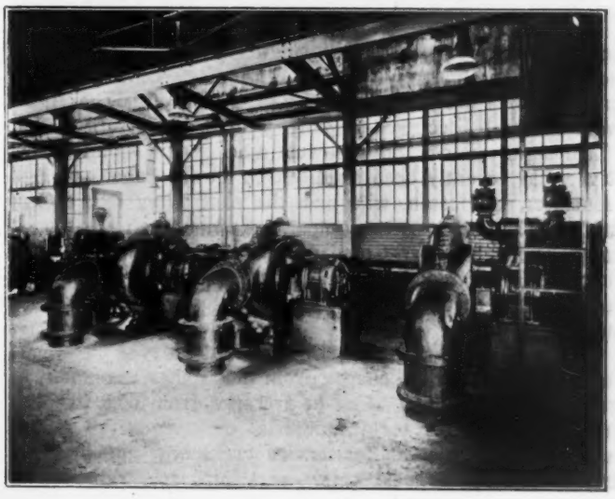


FIG. 1—MOTOR-DRIVEN COMPRESSORS FURNISHING AIR FOR FORGE AND ANNEALING FURNACES

These sets, shown in Fig. 1, deliver into a common discharge pipe, from which the air is distributed to the individual forge and annealing furnaces. Each compressor is driven by a 50-hp motor and is designed to deliver 4200 cu. ft. of air against a pressure of 2 lb. per sq. in. when running at 3450 r.p.m. The load on the compressors is constantly changing owing to the varying number of forges and annealing furnaces in use at the same time. Flap valves are therefore installed in the discharge pipes from each

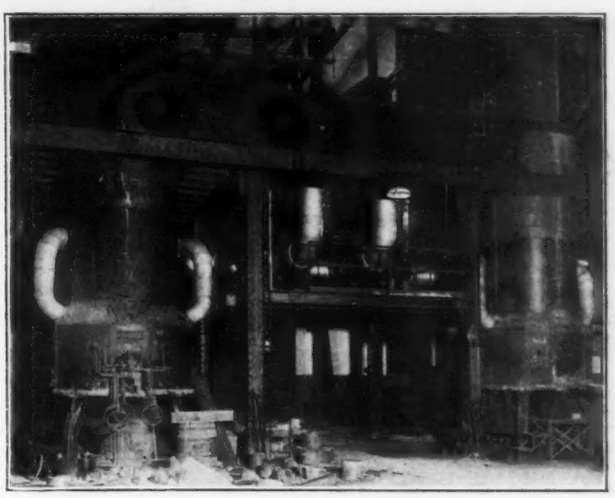


FIG. 2—CUPOLAS RECEIVING AIR FROM MOTOR-DRIVEN COMPRESSORS

unit to prevent air from flowing backward into the compressors.

Three more compressor sets, duplicates of those in use, will be installed soon to provide air for additional furnaces which will be added.

The two 10-ton cupolas shown in Fig. 2 are supplied with air from two smaller compressor sets installed on the raised platform. The piping is arranged so that either com-

pressor set can deliver air to either cupola. The compressors will deliver 4500 cu. ft. of air per minute at 1 lb. per sq. in. pressure when running at 3450 r.p.m. The motors are rated at 30 hp.

Dodge Brothers contemplate erecting two more 115-ton cupolas, each of which will be equipped with electrically operated blowers.

## Central-Station Activity Near Springfield, Mass.

In connection with the introduction of hydroelectric service in the outskirts of Springfield, Mass., by the Amherst Power Company, various subsidiary central-station organizations are undergoing rapid expansion. The Agawam (Mass.) Electric Company, with headquarters in the Mittineague district on the west side of the Connecticut River, has recently been acquired by Philip Cabot and his associates, of Boston, who own the controlling interest in the Turners Falls Power Company, Easthampton Gas Company, Amherst Power Company and other utilities. Coincidentally with this change in ownership, the Agawam corporation has become a distributing company of diversified output.

A transformer substation of the outdoor type has just been completed, where energy from the Amherst company's transmission line is reduced in pressure from 66,000 volts to 13,200 volts for local industrial distribution to large users. Among such motor-service users now supplied by this secondary network are the Northern Connecticut

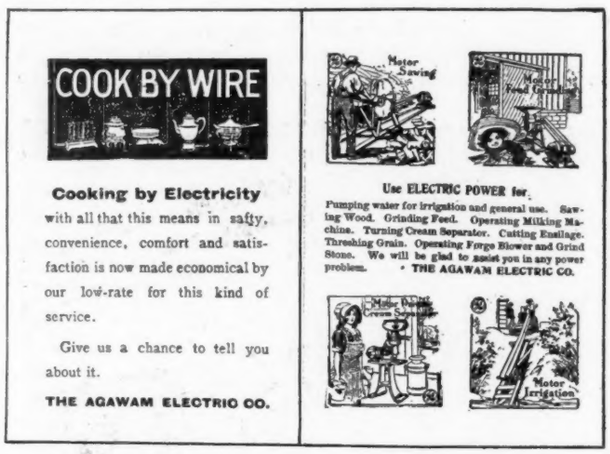
CENTRAL-STATION MOTOR-SERVICE SIGN

Light & Power Company, the Ramapogue Ice Company, the municipal pumping plant at West Springfield and the Lane quarries. A number of other large power contracts are in sight.

Since the acquisition of the property by the Cabot interests, the cost of lighting has been reduced 2 cents per kw-hr. to a maximum net rate of 11.7 cents per kw-hr., and the maximum motor rate has been cut from 10 cents to 4 cents per kw-hr. The lighting and motor rates diminish according to a sliding scale to minima of 7.2 cents and 1.8 cents respectively. The company has adopted the slogan "Cook by wire" on its lighting-bill stubs and sells energy at motor-service rates for heating and cooking service. On the studs of its motor-service bills are printed effective illustrated advertisements of electricity in farm service.

## An Effective Central-Station Motor-Service Sign

The accompanying photograph illustrates a large electric sign advertising the motor service of the Edison Electric Illuminating Company of Boston, Mass., the sign being located on the roof of a building in South Boston immediately opposite the entrance to the South Station yard,


COOK BY WIRE
Cooking by Electricity
with all that this means in safty, convenience, comfort and satisfaction is now made economical by our low-rate for this kind of service.
Give us a chance to tell you about it.
THE AGAWAM ELECTRIC CO.
Use ELECTRIC POWER for
Pumping water for irrigation and general use. Sawing Wood. Grinding Feed. Operating Milking Machine. Turning Cream Separator. Cutting Ensilage. Threshing Grain. Operating Forge Blower and Grind Stone. We will be glad to assist you in any power problem.
THE AGAWAM ELECTRIC CO.
Motor Irrigation

REVERSE SIDE OF STUB ON CUSTOMERS' LIGHTING BILL

where it is visible to all passengers on the railroad lines entering the city by this terminal. The sign is about 30 ft. high and 45 ft. long and is of the movable display type, carrying the words "Edison Power Best and Cheapest," with flasher connection, and a view of a mechanic in a motor-driven shop sharpening a tool at a grinder.

The lighting equipment of the sign is as follows: Mechanic's coat and head, thirty-one lamps, white and red, 30 watts each; mechanic's trousers, seventeen 30-watt blue lamps; tool, one 30-watt blue lamp; emery wheel, thirty 30-watt blue and red lamps; spark display, twenty-seven 10-watt amber lamps; two belts, each fifty-four 10-watt lamps, the motor belt being amber and the drive from the countershaft white lamps; countershaft, seven 30-watt red lamps and twenty-four 10-watt amber lamps; motor, thirty 30-watt blue lamps; sign letters, 343 10-watt plain white. The cost of the equipped sign complete was about $1,000. All the lamps in its service are of the carbon-filament type, and the outfit is carried on an angle-iron frame as shown. Nearly 1000 trains per day enter and leave the Boston South Station in full view of this display.

## Large Output of Electric Coal Breaker

By the substitution of mechanical devices for human labor in the Truesdale breaker of the Delaware, Lackawanna & Western Coal Company, the largest output ever scored by a breaker in the anthracite fields of Pennsylvania was made last month, when 108,220 tons of coal were prepared, 105,020 of which were shipped, or 4040 tons a day. The breaker has a capacity for twice the output when the coal can be supplied at that rate. Every unit of machinery in it has its individual electric motor, and it is estimated that the output of the breaker for the year will be approximately 1,060,000 tons, or considerably over one-seventh of the entire anthracite output of the country.

## A Central-Station Service Code

The following paragraphs are extracted from the admirable and inspiring service code of the Union Electric Light & Power Company, St. Louis, Mo., and reflect the frank spirit which characterizes the company's printed statement issued as a yellow-bound booklet of eight 3.25-in. by 6.25-in. text pages:

"Without consumers there would be no Union Electric Light & Power Company.

"These are simple facts easily understood. It therefore behooves every man and woman in our employ to remember this always, and to see that every customer is treated with courtesy and proper consideration.

"Any member of the force who lacks the intelligence to interpret the feeling of good will and fair treatment the Union Electric Light & Power Company holds toward its customers cannot stay very long with us.

THE EMPLOYEE AND THE CUSTOMER

"New customers are just as valuable to us as old customers—remember that; for each new customer is an old customer in the making.

"See that you do your part to make the customer feel that everybody's business is appreciated.

"Impress upon him the fine good-fellowship in our company, the no-trouble-to-show-you spirit.

"When a customer walks in meet him half way by showing an interest in what he wants or in any information he may be seeking.

"You must take the customer and handle him according to conditions and the particular mood in which you find him.

"The stranger in antiquated raiment may be one of the best customers on our books.

"Always remember, the customer pays your salary. He is your immediate benefactor.

ARGUMENTS WITH CUSTOMERS PROHIBITED

"At rare intervals some perverse member of our force disagrees with some customer as to the rightness of this or that. He maintains that he had no instructions to make a quick connection when the customer says he had; or that the order was for 60-watt lamps instead of 40-watt; or that it was a 16-in. fan and not a 12-in. fan; or that this was ordered and not that. Either may be right. But these are permanent instructions: No employee of the Union Electric Light & Power Company is allowed the privilege of arguing the point with the customer. He must adjust the matter at once in a pleasant and satisfactory manner to the customer, or call his superior to adjust it. Wrangling should have no place in the Union Electric Light & Power Company.

"Our business is successful, and there is good reason for it.

"The reason is that we give good service at reasonable prices and with the right kind of people to handle the business.

"Everyone from the errand boy up to the boss is working all the time to give the customer the service he wants.

"Ike Milliken says: 'Most of the big men got the big jobs by making the little jobs bigger.'

THE CENTRAL-STATION IDEA OF "SERVICE"

"The company has incorporated in its trade-mark the word 'service.'

"Upon this word 'service' rests the reputation of the company.

"Back of this word 'service' is a water-power plant of 120,000 hp and a central steam generating station of 100,000-hp capacity, with a record of twenty-four hours a day for seven years without five minutes' loss of time; an underground and overhead distributing system second to none; a highly efficient and well-trained corps of trouble men with a fleet of automobiles on duty day and night; an organization of officials, salesmen and clerks trained to the highest degree of efficiency.

"We have a reputation for rendering service which the head of every department is instructed to maintain.

"This reputation has cost us and the men before our time untold labor in building it up to this perfection.

"Filling orders as given and making deliveries as promised is good service.

"It is the object of the Union Electric Light & Power Company to sell its customers just what is wanted and with the very best service.

"The service of a company like ours is not a thing supplied by any single individual. It is not special attention to any one customer.

"Service means the limit of courteous, efficient attention from each particular customer or order.

TAKING PAINS TO PLEASE THE INDIVIDUAL

"It rests with every employee of this company (errand boy, order clerk, salesman, telephone operator, cashier, manager) whether the customer goes away disappointed or pleased.

"The clerk can wait on a customer in a 'What-do-you-want?' manner that will stick in the customer's 'crop' and make him feel that there is something radically wrong with the business and make him regret he came in, or he can wait on the customer in such a manner that he will go out of his way to do business with us.

"If the customer asks for a quick connection, don't get rid of the matter by answering, 'It will be made right away,' without knowing or getting information from the operating department whether it is possible to accommodate the customer.

"Sometimes it is impossible to make delivery that the customer wants, and sometimes no trouble at all when you explain the importance of the delivery to the proper department.

"For it would be better to lose the order than to have a disappointed customer on account of not being able to carry out your promise.

"An operator or clerk who is quick to answer telephone calls and does not keep a customer holding a cold receiver to his ear, listening intently to nothing, can swell the appreciation of our service and swell our appreciation of himself or herself.

"The courageous salesman asserts his belief with great frankness, and the frank man carries conviction.

"Every employee is advanced according to the service rendered to customers of the Union Electric Light & Power Company.

"If a customer is not able to make up his mind regarding what he wants, make up your mind to assist him."

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## Vacuum Cleaning Recommended for Chicago Schools

In the report of the Chicago Civil Service Commission on engineer and janitor service the commission has recommended that the Board of Education consider electric vacuum cleaning for 300 of Chicago's largest schools. With energy costing 3.5 cents per kw-hr., it is estimated that the interest, depreciation, maintenance and cost of energy will be about $100,000 annually for these buildings. However, the commission balances against this cost the advantages of more sanitary and thorough cleaning, relief from much of the dusting necessary at present, and the fact that teachers and pupils might stay after the close of school if desirable, whereas now they are driven out by janitors wishing to sweep. It is further asserted that with vacuum cleaners the engineers' assistants would be able to work several hours more per day than at present, since they could clean certain schoolrooms while teachers were still using others.

# Illumination and Wiring

## Artificial Illumination on Another Poultry Farm

An increase of 30 to 40 per cent in the number of eggs laid on the poultry farm of Mr. W. H. Cook, Orpington, Kent, England, as the result of installing electric lamps in the hen-houses, is reported in a recent issue of the weekly bulletin of the Canadian Department of Trade and Commerce, Ottawa. The Cook farm has nearly 200 yd. of fowl-houses, containing about 6000 birds, and these runs have been artificially lighted during the dark mornings and early nights of the last year. The fowl-houses are lighted by 300 lamps, divided into 32-cp, 16-cp and 8-cp sizes. These are switched on at 6 o'clock in the evening. After 9.30 the 16-cp lamps are employed, and at 10 o'clock the 8-cp lamps are substituted for a quarter of an hour before the hens are left in darkness. Mr. Cook explains that it is necessary to give thus a rough imitation of the setting sun, otherwise the hens would go to sleep on the ground and become a prey to parasites. In the case of young artificially incubated chickens the electric light is employed to make them feed longer, and this Mr. Cook has found accelerates their growth during the winter months by almost one-third.

## Lighting of an Automobile Salesroom

The recently completed service station and salesroom of the White Company at 930 Commonwealth Avenue, Boston, Mass., represents an advanced type of building devoted to motor-car marketing. Electric service is supplied by the Edison Electric Illuminating Company of Boston, and the lighting of the salesroom has been worked out with unusual care. The accompanying photographs show the salesroom interior by daylight and the same room seen from outside the building at dusk with the inside lamps in operation. The salesroom is approximately 90 ft. wide by 96 ft.

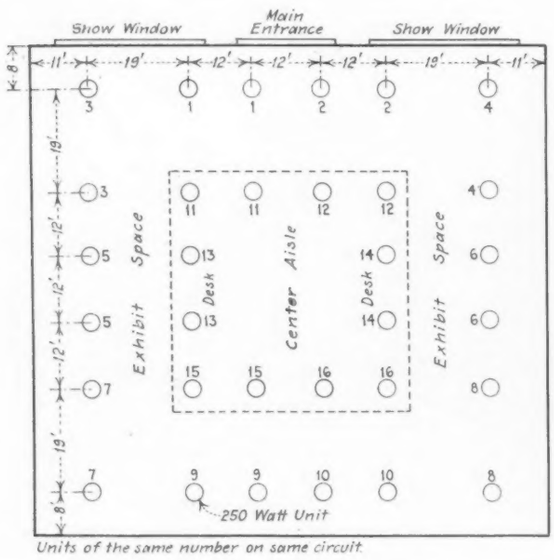



FIG. 1—ARRANGEMENT OF LIGHTING UNITS IN AUTOMOBILE SALESROOM

long and its height is about 23 ft. It is provided with a cement floor and the walls are decorated with a cream-colored tile border extending about 9 ft. from the floor, the remainder of the space between the border and the ceiling being treated in white and green with nature scenes painted in soft tints. Thirty-six 250-watt lamps are installed for the general interior lighting, each being housed in a Holophane No. 1215 Veluria semi-indirect bowl reflector hung about 13.5 ft. above the floor.

The lamps are controlled in pairs by knife switches located in a wall cabinet in one corner of the room and are operated from a 110-volt circuit, all wiring being in concealed conduit. Twelve of the lamps are hung below a central skylight as shown in the accompanying drawing.

FIG. 2—AUTOMOBILE SALES BUILDING AT BOSTON, SHOWING INTERIOR LIGHTING

This central area is devoted to office purposes, two rows of desks being placed on each side of a center aisle leading from the main entrance to the rear of the room. The space outside the skylight projection is devoted to displays of pleasure cars and trucks, there being twenty lamps hung around the outside of the room to provide for easy inspection of the machines exhibited. Outlets for portable lamps are installed at various points in the walls and floors as well as on two sides of each of the four central columns supporting the roof at the outside points of the skylight section.

Each of the two show windows is equipped with two trough reflectors, one being installed at the bottom of the window in a recess sloping upward toward the main floor of the room and the other being set as a cross-bar near the top of the lower window section. Each trough is provided with twenty 40-watt lamps with clear bulbs, located 12 in. apart on a horizontal axis parallel to the window. The lower section of the window in each case is 14 ft. high, the upper portion being 5 ft. high, and the total length 21 ft.

FIG. 3—INTERIOR OF SALESROOM, SHOWING INDIRECT FIXTURES

The lamps are screened by their inclosing reflectors so that no glare reaches the eyes of persons viewing the cars from outside the building or at a reasonable distance from the window. The installation of the lower reflector troughs in a recess helps materially in securing this result.

The reflector lamps are controlled by flush switches installed in the wall on either side of the main entrance, and the supply of energy to the upper reflector lamps in each window is effected from outlets at the top of the window, with inconspicuous leads to the lamps. Each desk is equipped with both a telephone and a 20-cp portable lamp with adjustable brass-finished reflector, two floor outlets for these services being located below each desk. Outside the building a fixed electric sign equipped with 112 10-volt, 5-watt lamps and two five-lamp ornamental standards are in regular service. The Lord Electric Company, of Boston, was the wiring contractor for the installation.

## Construction of Concrete Lighting Standards at Eldorado, Kan.

Eldorado, Kan., recently installed an ornamental lighting system, using concrete standards of an inexpensive type. The installation was financed by the Eldorado Electric & Refrigeration Company, which now charges for the street lighting at a yearly rate which, besides defraying the cost

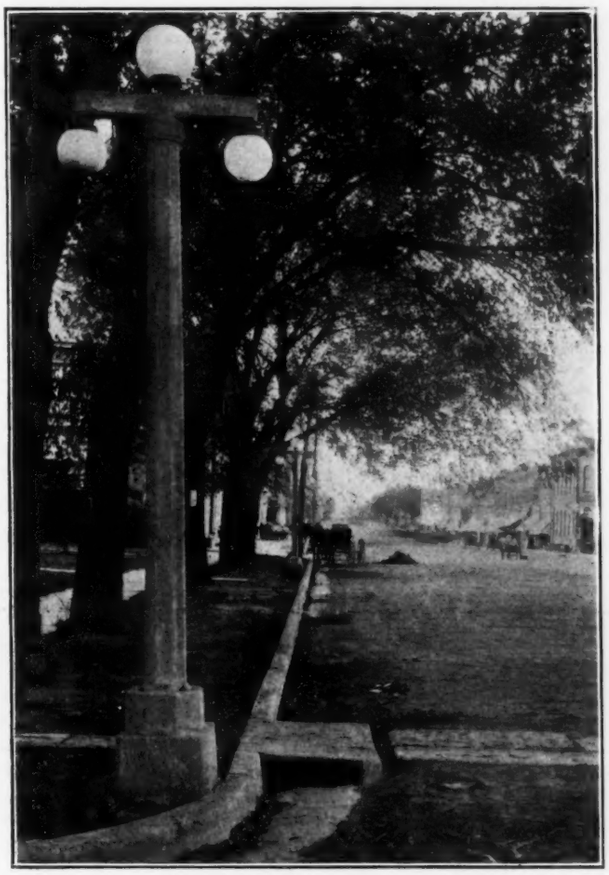


FIG. 1—STREET-LIGHTING POLE INSTALLED IN ELDORADO, KAN.

of operation, will in ten years repay the original outlay in installation expense.

Before selecting the concrete posts finally used, cast-iron standards of various types were considered, but their cost was found to be prohibitive. No trolley poles were available for supporting the lamps so it was decided to design an ornamental concrete post which could be made on the job. Fig. 2 is a working drawing of the standard installed.

The posts are octagonal in cross-section and measure 12 ft. in height above the concrete base to which they are anchored. Fig. 1 shows one of the posts completely equipped. The post is made in four parts, viz., a concrete base of a square cross-section, the column proper which is reinforced by a 1.25-in. pipe through its center, a concrete cross-arm supporting two inverted lamps and one upright lamp, and an octagonal collar which joins the top of the column to the cross-arm, adding to the appearance of the pole. The cross-arm is reinforced by a 0.75-in. pipe, which is connected with the vertical 1.25-in. pipe, as shown in the detail drawing. These pipes also serve as conduits for the wires. A 0.75-in. cross-pipe fitting connects the reinforcing pipe in the arm with the upright lamp outlet and also with the vertical conduit.

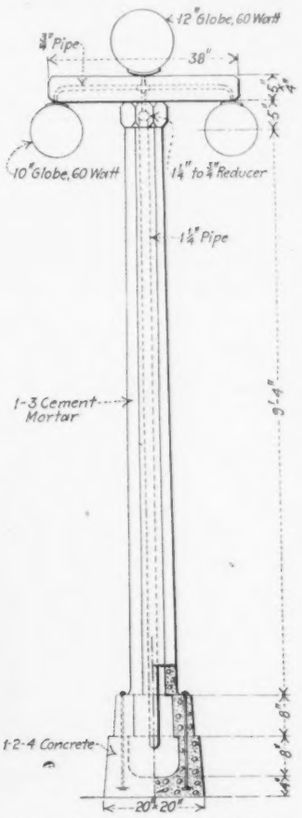



FIG. 2—DETAIL OF ORNAMENTAL CONCRETE POLE

Each post is equipped with three 60-watt tungsten lamps inclosed in milk-glass globes. The two lower globes are 10 in. in diameter and the upper one is 12 in. in diameter. The lamps are supplied from two separate 110-volt circuits, so that only part can be turned on if desired.

Concrete consisting of sand and cement in the ratio of 3 to 1 was used for the columns, collars and cross-arms in order to give these parts a smooth appearance. For the base a mixture of cement, sand and crushed rock in the ratio of 1, 3, 4 was used, to insure a more rugged construction. Five forms were made up of 1-in. cypress in which to mold the parts. These forms were made in halves, and before the concrete was poured they were clamped together with 0.25-in. by 0.75-in. bands. The ornamental collar is constructed with a central core, which makes it a simple matter to fasten the pipe from the cross-arm to the vertical pipe by means of a 0.75/1.25-in. reducer.

The arms and poles were assembled and wired before the posts were erected, the joints being closed with fresh cement.

Fifty-four posts were constructed in this manner, erected and fitted with lamps, globes and holders at a total expense of $441.41, or $8.17 per standard. According to the bids submitted for other concrete and iron poles, the lowest price for which the poles alone could have been purchased without fixtures was $1,134. A saving of $864 was thus realized by the electric service company in making its own poles.

The lamp standards are located at distances of about 91 ft., measured center to center, along six blocks of the city's business district. This arrangement allows eight posts to the block, four being placed on each side of the street. The system has been designed for a 5 per cent voltage drop. At present only twenty of the lamps burn all night, the remainder being extinguished at midnight.

The system has been installed since Feb. 1, 1913. No trouble has been experienced from disintegration of the cement and the maintenance to date has totaled only $23.50. Thirty-six lamps have burned out in that time and two

globes have been broken. The total cost of the installation, including the underground system (which consists of two 110-volt circuits carried in 600-volt lead-incased cable inclosed in fiber conduit), amounted to about $2,000, or 43 cents per foot of frontage, including street crossings.

A ten-year contract for lighting the city has been secured and Mr. F. A. Pielsticker, general manager of the Eldorado Electric & Refrigeration Company, feels sure that the poles will outlast the contract. The rate for lighting has been made on the basis of 10 per cent depreciation. Seven cents per kw-hr. is charged, but this rate varies according to the number of hours which the lamps burn. The annual rate is $10.50 per year for lamps burning until midnight. The city defrays about one-third the cost and the merchants benefited by the illumination pay the other two-thirds.

COST OF CONSTRUCTING AND INSTALLING 54 CONCRETE STANDARDS

| | |
|---|---|
| Cement, 9,400 lb. at 45 cents | $42.75 |
| Sand, 29,430 lb. at 7.5 cents | 22.07 |
| Pipe fittings | 50.90 |
| Globe holders, 153, at 50 cents | 76.50 |
| Sockets, 153, at 17 cents | 26.01 |
| Forms, five, at $4.00 | 20.00 |
| Labor | 36.50 |
| Glass globes, 153 | 67.00 |
| Wire, 1,500 ft. | 23.18 |
| Lamps, 153 | 76.50 |
| Total | $441.41 |
| Cost per pole | $8.17 |

## Lighting of the Cleveland Art Loan Exposition

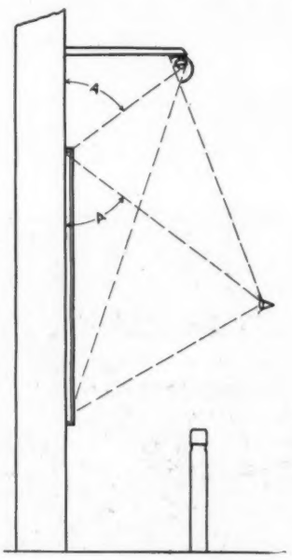
While lighting alone does not make a painting, improper lighting can rob a masterpiece of the effect the artist wishes to produce. He sees and paints a scene under conditions of natural light which will hardly ever be exactly duplicated in nature, for the spectrum of natural light is in a state of continuous change. So the artist must look to artificial light to show his work at all times to the best advantage—to have his picture give to the observer the impression he received from nature when he painted it. In addition to using light sources of proper color, it is necessary that these sources be so placed as to give proper direction to the light rays and so eliminate glare and reflected images. Only by carefully applying the principles of illuminating engineering in the design of a lighting installation for art galleries can the proper results be realized.

The lighting of the art loan exposition held recently in Cleveland, Ohio, furnished an excellent example of the application of scientific principles in the illumination of art. This exhibit contained paintings valued at about $3,500,000, and each of the paintings was lighted separately with a view to its own requirements.

The accompanying diagram shows the type of construction used. A trough, containing the light sources, was placed above and in front of the paintings in such a manner that under ordinary conditions the light sources were entirely cut off from the view of the observer. This trough was painted black on the inside to prevent reflection. Inside of the trough a line of conduits was arranged with incandescent lamp outlets spaced at intervals of 1 ft. The lamps were inserted in a horizontal position and were equipped with half-shade reflectors. As shown in the sketch, the angles of incidence and reflection being the same, no directly reflected light from the lamps could reach the observer's eye. The use of these reflectors gave a flexible arrangement whereby the distribution of light on various parts of the picture could be readily controlled. Each alternate socket was equipped with a 40-watt, 105-volt tungsten lamp. Colored lamps, corresponding to the tones which it was desired to accentuate in the picture, were selected and placed in the remaining sockets. The amount of light of various kinds thrown on different parts of the picture was controlled by rotating the reflectors about the axes of the lamps. Although the line emf is approximately 116 volts, 105-volt lamps were used, and this color value of the light was considerably improved by the over-voltage operation.

There was no general illumination in the exhibit hall, practically all the light coming from the pictures themselves, and the effect was unusually pleasing. In fact, many of the pictures appeared to much better advantage under the artificial light than when viewed in daylight of the average quality. This was especially true in the case of early morning or evening pictures where red tones predominated.

The installation which is described above was designed by the engineering department and the physical laboratory of the National Lamp Works of the General Electric Company, at the request of the Electrical League of Cleveland, which was placed in charge of the lighting by the art exhibit committee.



SCIENTIFIC ART GALLERY ILLUMINATION

## Railroad Utilizes Brilliant Street Lighting for Advertising

One of the best lighted business streets in the Loop District of Chicago is Dearborn Street from Lake Street to Polk Street. Flame-arc lamps are used and they are suspended by brackets from the poles supporting the span wires of the street railway. This method of lighting was described in the *Electrical World* of April 19, 1913, page 833. At the south end of this brightly illuminated portion of the street is Dearborn railway station, used as a terminal by the Wabash, among other railroads. It is interesting to note that this railroad in recent advertising literature takes advantage of the illumination as making the principal avenue of approach to the station more attractive. "Patrons of the Wabash Railroad," it says, "will be pleased to find Dearborn Street, from Wabash station north through the heart of the business district, one of the best lighted streets in the whole world. You can read your newspaper at midnight anywhere on this 'new white way.'" This advertising literature has made Dearborn Street's good lighting familiar to thousands of travelers.

### Recent Telephone Patents

The selective system patented by Mr. J. H. Mattice, of Clyde, Kan., is provided with a controller which will fail on either too small or too large a direct current, and selection is effected by controlling the quantity of current.

Mr. W. A. Morse, of North Grosvenor Dale, Conn., has patented a telephone lockout system in which the locking feature is under the control of the calling station. In his system the lockout apparatus is arranged in a special case adapted to be secured to an ordinary telephone. All stations are locked out unless the line is released by the calling party for the response of another station.

It frequently happens that the same transmitter must be used almost continuously by several different persons usually to the exclusion of other persons. Mr. C. S. Warren, of Milford, Ohio, has provided an antiseptic mouthpiece device for such a condition, consisting of a clamp adapted to the case of the transmitter, upon which are mounted several individual mouthpieces, any one of which may be swung across the face of the regular mouthpiece at will.

## Letters to the Editors

### Hotel-Room Lighting

*To the Editors of the Electrical World:*

SIRS:—On page 1015 of the issue of the *Electrical World* dated Nov. 15, 1913, appears an article entitled "A Study of Hotel-Room Lighting" in which the author calls attention to the "poor standards of illumination still in vogue and the need for better service." I heartily echo those sentiments and suggest that if the room switch were placed on the lock side of the door, instead of behind it, the arrangement would give much "better service." Every drummer who must fumble and search behind the door for the lamp switch will express his thoughts in unprintable language.

The lighting designer's attention should be called to the fact that a man usually shaves himself before the bathroom mirror. When lamps are placed both above and behind him his face is necessarily in the shadow, a condition for shaving not conducive to good humor or productive of satisfactory results.

*Vallejo, Cal.* H. D. AUSTIN.

### The N. E. L. A. and Motor Service

*To the Editors of the Electrical World:*

SIRS:—In line with recent comments appearing in your columns, I believe with Mr. Stratton that the National Electric Light Association could well afford to lay more stress on the motor-service end of the central-station business.

While the electrification of factories of various kinds has increased by leaps and bounds, there remain to-day a surprisingly large number of manufacturers who still persist in sticking in the old rut. Solution of this condition is largely a matter of education. Were the matter forcibly brought to such a manufacturer's attention through some channel other than the central station (which has the axe to grind), the suggestion would undoubtedly receive consideration. It is here that the N. E. L. A. as a disinterested party could be of material assistance.

Just what form such activities should take is a matter for discussion. I would make the following suggestions: (1) Publication of literature specializing in various kinds of manufacture and giving detailed data on electrification methods applicable to each. (2) Organization of a clearing house for the interchange of ideas, experiences and results obtained by member companies in providing motor drive for various industries. (3) Collection of recommendations from manufacturers of electrical apparatus concerning types of motors and the results and economies to be obtained therefrom, for application to the special industries.

C. S. DAWSON,
*Power Engineer, Scranton Electric Company.*

*Scranton, Pa.*

### Ozone Machines and Public Health

*To the Editors of the Electrical World:*

SIRS:—Referring to the article in your issue of Nov. 15 entitled "Ozone Machines and Public Health," abstracted from a recent issue of the *Journal of the American Medical Association*, I wish to emphasize the caution already expressed by Dr. Charles P. Steinmetz in your issue dated Nov. 29, that the reader should not accept the conclusions of experimenters noted in the above-mentioned article without further evidence. After a careful study of their reports, I am convinced that many of the conclusions are imaginary and not proved by the results obtained. For example, tests were made on three men by placing them individually in front of a large ozone generator and delivering a strong blast of ozonized air at high concentration, the face of the victim being only a few inches from the outlet of the ozone generator. One of the victims had a "sore throat" ("cold") at the beginning of the experiments. The experimenters concluded, from the results of the test, that breathing ozone in strong concentrations produces sore throat. When we consider the probable effect of the blast of air on the face and head, the wind pressure on the nasal passages and the dust carried by the blast, it seems rather far-fetched to make any definite conclusions regarding the effect of ozone, especially from such a small number of tests and subjects. Furthermore, the conditions of the tests were extremely abnormal, it not having been proposed to use in ventilation concentrations exceeding one-tenth of that used in these tests.

The results of the bactericidal tests indicate that ozone in dry air has little germicidal effect. There is, however, overwhelming evidence which proves beyond a doubt that it will destroy germs in water. This fact has been thoroughly established by the best scientific authorities in Europe, in connection with the many municipal ozone water purification plants, as well as by the Pasteur Institute and the German Imperial Board of Health. The latter were able to destroy by means of ozone practically all germs in water containing as many as 30,000 cholera and 60,000 typhoid bacteria per cubic centimeter. As there is always considerable moisture in the respiratory passages, it is perfectly logical to suppose that the breathing of ozonized air may have some beneficial effect.

The fact that guineapigs died in an atmosphere of strongly concentrated ozone is not surprising, as there is no substance known to science which will destroy bacteria without also destroying animal tissue. For this same reason antiseptics cannot be used in full strength, and the best that is expected from their use is to stunt the growth and prevent the propagation of the bacteria.

The tests on the animals in the cages supplied with mild concentrations of ozone showed practically neutral results; that is, no pronounced beneficial or detrimental effects were noted. The duration of the tests was entirely too short to be conclusive.

The experimenters blew ozonized air on paper covered with lampblack to determine the effect of ozone on tobacco smoke. It seems to me the proper way to make such a test would be to use tobacco smoke instead of lampblack. Particles of carbon in lampblack are many times as large as the floating particles of tobacco smoke, and hence the oxidation of the latter in its very finely divided state might take place when lampblack would not be appreciably affected.

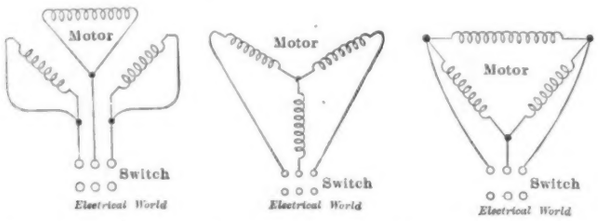
*East Pittsburgh, Pa.* W. H. THOMPSON.

# Field of the Operating Engineer

## A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

### Three-Phase Motor Switch Connections

One familiar with the details of a particular line of work may fail to appreciate the smallness of things likely to puzzle the novice. Note an instance where the water supply of a large summer hotel depended upon a three-phase motor, operated from double-throw switch that had six terminals, corresponding to the six leads brought out from




FIGS. 1, 2 AND 3—DIAGRAMS OF CONNECTIONS FOR THREE-PHASE MOTOR SWITCHES

the three-phase windings of the motor. The original object of the six terminal, double-throw switch was to permit starting the motor delta-connected and then to throw it over to a star connection for operating. Slight repairs necessitated sending away the switch; the hotel man marked the wires before disconnecting them and, ordinarily, would have had no trouble in reconnecting; but the switch returned had but three terminals to which to connect the six motor wires. This meant that the motor phase leads had to be jumped together in pairs, either at the motor or at the switch. With the assistance of the local electrician, the hotel man rang out the motor leads and he connected together the leads that rang together, thereby getting the open-circuit result indicated in Fig. 1. The inspector finally called in used the connections of Fig. 2 (star) in preference to those of Fig. 3 (delta), because the star connection is the easier on the motor phase winding insulation.

### Failure to Generate Due to Many Causes

Any one of several faults may prevent a dynamo from generating, but seldom do several exist to complicate matters. A large summer hotel was preparing for a record evening crowd. At 3 p. m. of the day of the assembly the dynamo gave out, and as a consequence the moving-picture machine could not be operated. An inspector was sent for, and when he arrived at 5:30 he tried reversing the connections of field at the generator, but could not get a spark. He noticed that the home-installed pilot lamp on the machine was burned out and further inspection revealed a short-circuited lamp socket. As the lamp was connected inside of the series field, this fault alone would have prevented generation. He disconnected the socket and turned out the shunt-field rheostat, but still the machine would not generate. Short-circuiting the rheostat with a wire was of no avail, so he went back to the machine, connected the shunt field across the brushes and rocked the brush holders one pole arc. The machine picked up promptly. The inspector then restored the former shunt-field connections to the switchboard and reversed the positions of the rheostat and shunt-field wires at the busbars; but when he turned out the rheostat the machine would not generate. He thereupon short-circuited the rheostat with a wire and the machine immediately picked up voltage. The rheostat was replaced by a good one, the rheostat and shunt-field busbar wires were interchanged, and the brushes were rocked back to their original positions. The machine was made ready for the load forty minutes after the inspector laid down his bag in the engine room.

### Designing Motor Installations for Improved Power-Factor

The speed of a motor has an important bearing on the power-factor obtained. In selecting a motor of the proper speed to drive a line shaft, as pointed out by Mr. W. J. Fitzgerald, of the Detroit Edison Company, before the recent Michigan convention, the designer should first decide on the maximum speed of the shaft, then using as large a speed reduction as practicable, but preferably not over five to one. The ratio is usually limited, however, by such conditions as the clearance between shaft and ceiling, and so usually works out at a three-to-one reduction, although four to one is possible in some cases.

Motors of as high a speed as each condition will warrant should be installed to reap the advantages of increased efficiency and power-factor and lower price. Yet it is not an uncommon thing to see a slow-speed motor belted to a

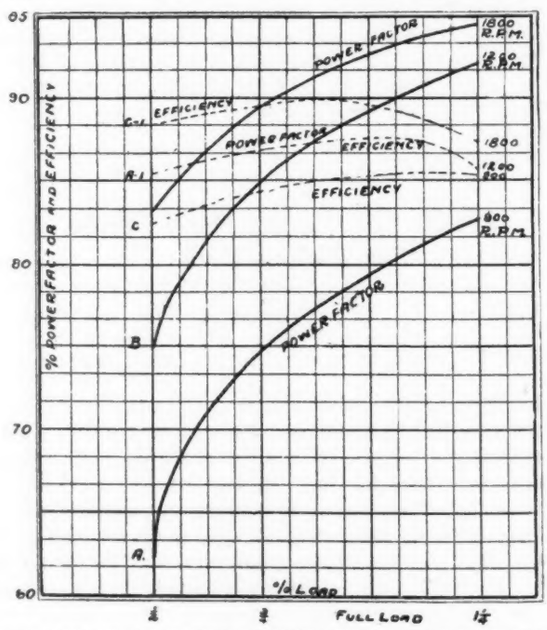



FIG. 1—RELATION BETWEEN MOTOR SPEED AND POWER-FACTOR

line shaft running at the usual speed, which in turn drives high-speed machinery. This operation of first decreasing the speed and then increasing it to meet the requirements of the high-speed machines means large losses in belt friction and slippage, besides the poor power-factor inherent in the slow-speed motor. Such practice, commented Mr. Fitzgerald, is deplorable when one realizes the benefits and

savings which can be secured by the use of high-speed motors and higher shaft speeds.

The accompanying curves show at a glance the difference in power-factor and motor first-cost for motor speeds of 900, 1200 and 1800 r. p. m. It will be noticed also that the efficiency changes only slightly, but while this makes little difference to the customer the improved power-factor ob-

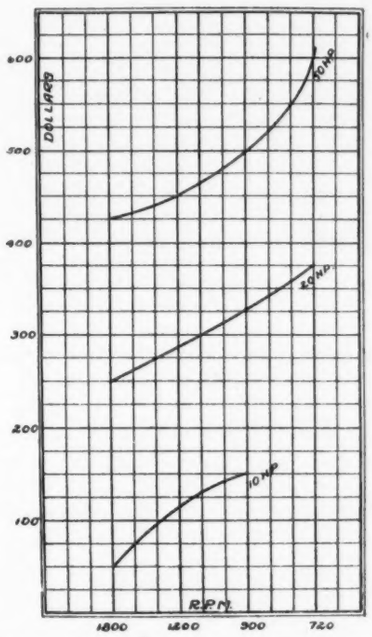



FIG. 2—RELATION BETWEEN MOTOR SPEED AND FIRST COST

tained is of vital importance to the central-station man.

To demonstrate how little a change in size of pulley is necessary to use a 1200-r. p. m. instead of a 900-r. p. m. motor, take the example of a 10-in. pulley on an 840-r.p.m. motor which with a 40-in. shaft pulley will drive the shaft at 210 r.p.m. To use an 1120-r.p.m. motor and have the shaft speed remain the same we must use a 7.5-in. motor pulley and 40-in. shaft pulley. To increase the shaft speed to 250 r. p. m. a 10-in. motor pulley and a 44-in. shaft pulley will give the desired result. Where the reduction cannot be accomplished in one step, a countershaft is frequently desirable. Back-geared motors also serve this purpose well where the right combinations can be secured with direct-connected or chain-driven machines.

## Eddy Current

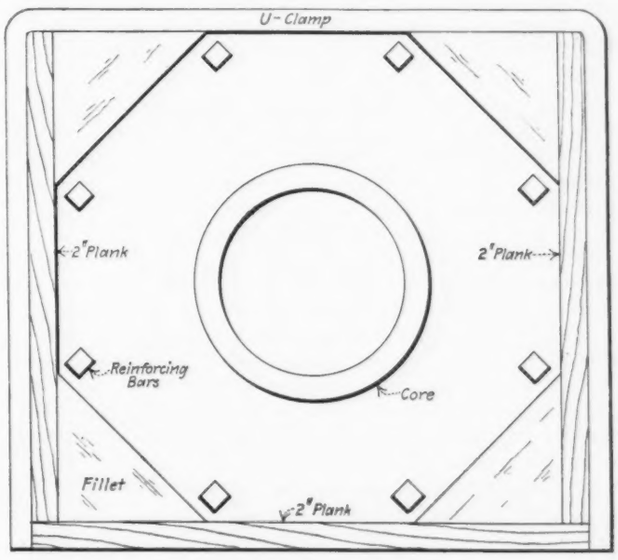
A mill operator claimed that a three-phase, slip-ring induction motor, operating a centrifugal drier in carpet works, had no torque. He further stated, what the inspector found to be true, that the motor, even when free, would not start on applying the voltage, but if started by hand it would continue to run at about half speed, although it could then be easily stopped by applying the palm of the hand to the pulley. The trouble was evident at a glance. The slip-ring motor required that an external resistor be connected across the rings by means of brushes and holders provided for that purpose and this external resistor was missing. All motors previously installed in the work were of the squirrel-cage type with the speed controlled from a variable resistor installed in the supply wires. Accordingly, the operator had installed the slip-ring motor in the same way, with the result that the motor would not start because its defined pole rotor was open-circuited. The fact that the rotor would run at reduced speed when started free by hand was due to the dynamic action of the eddy currents induced in the rotor core. The torque due to reaction between the stator field and that of the eddy currents was sufficient to keep such a small rotor turning against its bearing friction, but the least extra work imposed upon the shaft would overcome the turning torque and stop rotation. On very small motors equipped with ball bearings the friction losses are so small that the torque due to eddy-current reaction may be sufficient to start the motor and to bring the speed almost to synchronism, but the torque is not sufficient to do any useful work.

## Concrete Poles for Distribution Lines

Owing to the limited supply of good timber for pole purposes and to the cost of maintaining wooden-pole lines, the Riverside Light & Power Company, of Abilene, Kan., recently decided to engage in the manufacture of hollow reinforced-concrete poles for its own use. Square poles with chamfered corners were found to be very heavy with respect to their strength, so that octagonal poles are now being made. Incidentally, the electric-service company is also utilizing its line-construction force to better efficiency, employing the men during odd hours in the manufacture of the new poles. Four different sizes of poles are being made, ranging from 20 ft. to 35 ft. in length. All of the poles have 6-in. tops and the butts measure from 10 in. to 13 in. in diameter, according to the height.

Three-piece wooden molds are used, as shown in cross-section in the accompanying sketch. The form consists of a bottom plank and two side parts, one right-handed and the other left-handed. Strips having triangular cross-sections are fastened to the side pieces as shown, to give an octagonal shape to the pole.

Cement mortar, consisting of Portland cement and sand, in the ratio 1 to 3, is used in pouring the poles. Reinforcement is furnished by twisted square high-carbon steel rods placed longitudinally in the mold and spaced symmetrically. To prevent spreading, U-shaped irons are placed over the top of the form. To provide for bolting cross-arms on




CROSS-SECTION OF FORM WITH CORE AND REINFORCING IN PLACE

to the poles removable plugs extending diametrically through the forms may be used, but U-bolts passing around the pole and through the cross-arms are considered preferable by the company. Gains for the arms are formed by inserting blocks, while provision is made for steps by placing bolts in the form so that nuts may be supported at the center of the pole. The bolts are then backed out of the

nuts after the mortar has set, and steps are screwed in in their place.

When the mold is about one-third poured, a hollow, conical galvanized iron core having a base diameter of 6 in. and a top diameter of 2.5 in., is inserted in the mold and the remainder of the mortar and reinforcement is put in place. The core is wrapped loosely with a spiral of building paper, which facilitates the removal of the core after the mortar has set. The poles are constructed in a horizontal position and reinforced with four, six and eight bars as desired. The top of the mold is left open for pouring the mortar, and when it is filled the mortar is tamped down and troweled off smooth.

TABLE SHOWING COMPARATIVE COST OF POLES

| Height | Concrete | Cedar |
|---|---|---|
| 20 feet | $2.43 | $ 2.00 |
| 25 feet | 3.85 | 3.95 |
| 30 feet | 5.86 | 6.65 |
| 35 feet | 7.57 | 10.20 |

After the form is filled, the mortar is allowed to set for several hours, the core is then partially removed and the pole is allowed to set from twenty-four to forty-eight hours longer. For twenty-five to thirty days after the final set the pole is cured by wetting it thoroughly each day.

These concrete poles, while more costly than cedar poles in the small sizes, are considerably less expensive in the greater length, as indicated in the table. Erection of concrete poles is more expensive than erecting cedar poles, but the former are practically indestructible and present a better appearance. Pike poles may be used in erecting the smaller concrete poles, but a pole-raising machine is required with the larger ones on account of their weight. In sand or wet soil the company finds it advisable to set the poles in grout.

## Removing Soot and Other Deposits from Boiler Tubes

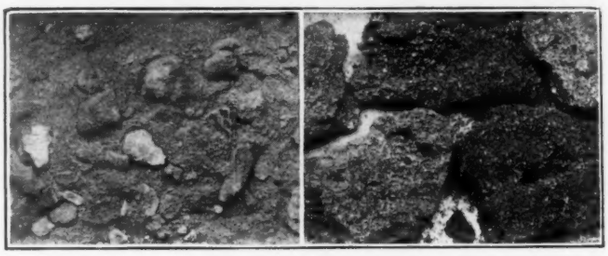
In estimating the heat-insulating effects of soot formations on boiler tubes engineers are likely to consider these values the same as for lampblack, although they are really higher. Deposits on boiler tubes vary widely in composition, and in addition to considerable ash carried over by the draft they contain much inorganic matter, which after being volatilized in the fire condenses on coming in contact with the comparatively cool tubes.

When the deposits first occur the ash is in the form of a dust or powder, but if allowed to accumulate the layers tend to fuse together and finally break up into clinkers. The formation of these clinkers is probably due to the fact that as the deposit becomes thicker its heat-insulating qualities increase, and as a result the hot gases cannot come into contact with the cool tubes; therefore, when the layers become thick enough a temperature is reached that is sufficient to fuse the material on the outside.

Soft coal is not the only fuel which forms soot deposits, as shown by the illustrations. Practically all boilers, both vertical and horizontal, irrespective of the kind of material burned, are subject to these deposits.

Deposits found in modern boilers may be classified into five different kinds of formations, as follows: (1) molten slag, which forms as stalactites on the lower row of tubes when set close to the fire (this formation is not common and cannot be blown off); (2) clinker on the top of the tube, found only in the first pass (Fig. 2); (3) cemented mass of clinker, found only in the lower rows of the first pass (Fig. 7); (4) scaly deposit due to moisture in products of combustion cementing the ash deposit, found frequently throughout the boiler (Fig. 3), and (5) loose soot, fine ash, clay and other earthy matter.

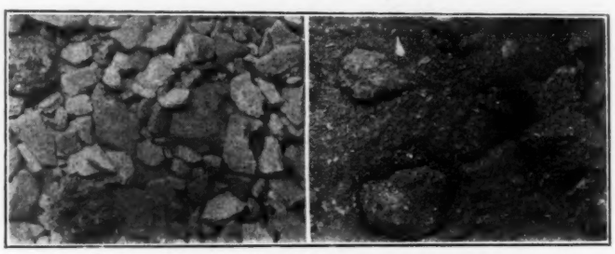
In Fig. 1 is shown a deposit taken from the first and second passes of an Edge Moor boiler, where garbage was used as fuel. The deposit is made up largely of a fine powder with small cakes fused together. It is gritty and



FIGS. 1 AND 2—SOOT TAKEN FROM BOILER USING GARBAGE AS FUEL

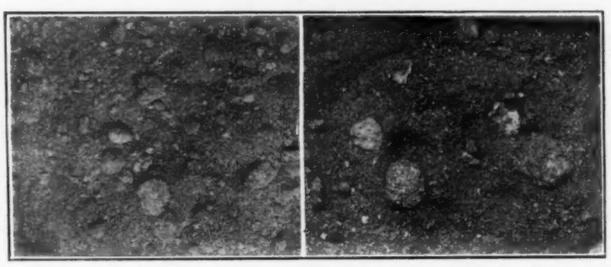
light gray in color. The powder is non-combustible and when heated to a moderate degree will fuse. Fig. 2 shows a sample of deposit taken from the lower row of tubes of this same boiler. The deposit is a light porous clinker forming on top of the first deposit and shows how the first powdery deposit, which can be easily removed, will fuse together and clinker under the action of heat.

A deposit taken from a hand-fired Babcock & Wilcox



FIGS. 3 AND 4—DEPOSIT ON FLUES WHERE BUCKWHEAT COAL IS USED

boiler using buckwheat coal with an ash content of approximately 16 per cent is shown in Fig. 3. This deposit has the appearance of scale, being white and soft and made up almost entirely of ashes. The small cakes can easily be pulverized in the fingers, giving a powder as smooth and fine as talcum. It is non-combustible and cakes around the entire tube. It can be easily blown off. Fig. 4 shows a deposit which was formed on the top of that shown in Fig.



FIGS. 5 AND 6—DEPOSIT IN STOKE-FIRED BOILER USING SHAWMUT COAL

3. It is gritty and is formed from the ash carried over by the draft. It clinkers slightly, forming a light porous substance, and if not blown off finally bridges over the tubes.

The deposit shown in Fig. 5 was taken from the tubes of a Babcock & Wilcox boiler using Shawmut coal fired by Roney stokers. Although this is soft coal, the deposit is gritty and made up largely of ash. In Fig. 6 the deposit

shown was taken from a boiler in the same plant as that in Fig. 5. It is nearly black and is made up of ashes and soot. The soot will burn out and the ashes will clinker when subjected to heat. In Fig. 7 is shown a deposit taken from the lower rows of tubes in another boiler in the same plant as that from which the samples shown in Figs. 5 and 6 were taken. It is hard, brittle and porous and looks like slag. It is a good example of what results if the first layers of soot and other deposits are not removed frequently.

Use of high drafts and the forcing of boilers at continous overloads tend to increase the deposits on boiler tubes. The high drafts take up the lighter non-combustible particles from the fire, carrying them over and depositing them on the tubes. The same result is obtained with stokers and the consequent use of large quantities of fuel per square foot of grate area. A high rate of driving also produces higher gas temperatures throughout the boiler, making fusing more probable.

Besides the direct heat insulation resulting from these deposits, the gases of combustion are retained in the cells of the porous clinker formations, thus greatly increasing the depth of the stagnant gas film around the boiler tubes and further reducing the heat transmission. The formation of this porous clinker also renders ineffective the scrubbing action of high-velocity gases in removing the film. Furthermore, when the clinker gets thick enough to bridge over adjacent tubes, as shown by the sample in Fig. 7, it seriously interferes with the draft.

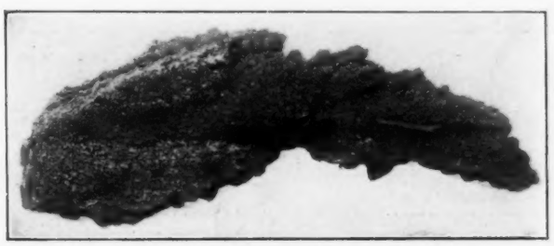


FIG. 7—SAMPLE OF LARGE CLINKER

Most boilers are not designed so that the cleaning of the tubes can be done properly. Usually the only provisions for removing the deposits are a few portholes in the sidewalls of the setting. Through these doors, some of them at a great height from the floor, the fireman is supposed to insert a perforated steam pipe and blow off the soot and other matter. This is an awkward and dangerous job because the pipe is hot, and the task will be shirked as much as possible. The method is also inefficient, since only the parts of the tube near the blow doors are cleaned, the soot being blown away to tubes more distant. In fact, no boiler 10 ft. or more wide can be cleaned by hand unless spaces at the side are unusually ample, thus wasting valuable ground space. More satisfactory results can be obtained with a cleaner installed as part of the boiler equipment. In this case steam may be discharged through perforated pipes and nozzles to the tube surfaces, in that manner cleaning the tubes in the center of the boiler as well as those at the sides.

## Outdoor Testing of Insulators

The Western Electric Company's engineering department in New York City is conducting an interesting comparative study of pole-line insulators. Over 3000 insulators of different shapes and materials are mounted on a low roof in one corner of the West Street building. A special selective mechanism is mounted on a pole near the center of the insulator rack, which permits the insulation resistance of each group of insulators to be measured with instruments that are in the physical laboratory. The laboratory is several hundred feet away and only a few very heavily insulated wires connect the selector to the laboratory. Dust from the street and smoke and soot from nearby factory chimneys gradually accumulate on the insulators and their insulation resistance measured during wet weather decreases. The ability of the insulators to maintain high insulation under these severe conditions determines clearly their relative merit for use on telephone lines and in telegraphic service.

## Blasting by Electricity as a Means of Reducing Miner's Phthisis

During the last six months some of the leading gold-mining companies in the South African Rand have been conducting experiments with electric blasting to test the theory that this method will assist in minimizing the fine dust from blasting—accepted as the most direct cause of miner's phthisis, which is at present so widespread in the Rand field. The management of one large company has decided to introduce the electric system throughout its mine. It is hoped to have the electric system of firing so introduced that blasting can be done by pressing a button on the surface. This will insure that the miners will not be forced to inhale the fine dust and vitiated air which result from blasting carried on underground.

## The Inverse-Square Law in Illumination

If a certain object is 20 ft. from a source of light, to what extent will the illumination falling on it be reduced if it is removed to a distance of 60 ft.? A. W. W.

The intensity of illumination varies inversely as the square of the distance from the source. If an object is removed to three times its former distance, as in the case cited, the intensity of the light falling on its surface will be in accordance with this rule reduced to one-ninth the value that it formerly possessed.

## Failure of Polyphase Meter to Operate

I have a three-phase, 25-cycle, 110-volt, 5/60 amp watt-hour meter connected in circuit with a 50-hp motor which is operating at three-fifths its rated load, and still the meter fails to record. The connections are correct, I believe, the grounded terminals of the potential and current transformers being connected to one side of the meter and the two remaining wires on the potential and current transformers to the other side. Am I correct in saying that a three-phase meter will not register with 50 per cent power-factor? The magnets and current coils in the meter are in good condition. J. W. C.

When a three-phase watt-hour meter is connected in circuit properly it should register the energy consumed independently in every respect of the power-factor. Your statement that the three-phase meter will not register when the power-factor is below 50 per cent is probably based on the fact that when two separate meters are employed to measure three-phase energy one of the meters registers zero when the power-factor is 50 per cent and gives a negative reading when the power-factor is below this value. No doubt the meter referred to in your inquiry is incorrectly connected in circuit. A convenient method of determining the proper connections to the meter is to operate one element of it (that is, one series coil with the corresponding shunt coil) as in a single-phase meter. In this case the meter should operate in one direction or the other, except when the power-factor is exactly 50 per cent. By testing in this way two separate single-phase circuits you should be able to determine whether the meter is operating correctly, and if not what changes to make.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Power-Factor Effects of Railway Motor-Generators and Rotary Converters.*—Nicholas Stahl.—An article comparing the power-factor effects of synchronous motors and rotary converters. The synchronous motor, commonly utilized as part of a motor-generator set, has come to be accepted as an excellent agent for improving the power-factor of systems. But such a synchronous motor will fulfil expectations only if it is operated properly; simply putting the motor on the system and turning it over to the care of the average station operator will in most cases give results that fall far short of expectations with regard to corrective effects. The curves given indicate the necessity of careful attendance and show that the field strength must be varied with changing conditions of load if the desired results are to follow. The rotary converter, on the other hand, while not inherently designed for power-factor correction, is shown to be an excellent medium for the automatic maintenance of constant power-factor. The article then goes further in demonstrating that in cases where a wide variation in load occurs the best average condition is obtained through the use of a rotary converter rather than through a motor-generator set as ordinarily manipulated.—*Elec. Journal,* Dec., 1913.

*Frequency Changers.*—G. Harris and L. B. Bonnett.—The need of frequency-changer sets is experienced where, for instance, a 25-cycle system is to supply lighting to the communities in its neighborhood, or where a 60-cycle system must furnish energy at 25 cycles or less for railway operation, or where two systems of different frequencies are to be tied together. The authors discuss the types of frequency-changer sets which have been commercially developed, describing in particular the synchronous-synchronous sets and the induction-synchronous sets. Reference is made to the matter of the most suitable speed for a given set of conditions and the limitations on rating imposed thereby, and to the more important features embodied in present-day construction. The proper procedure to be followed in starting synchronous sets is fully described, and this is followed by an outline of the operations necessary to secure parallel operation of frequency-changer sets, together with a discussion of the interrelations between the machines on the motor end and on the generator end.—*Gen. Elec. Review,* Dec., 1913.

*Turbo-Alternator.*—An illustrated description of a 4200-kw Oerlikon turbo-alternator in a British central station, running at 3000 r. p. m.—London *Electrician,* Dec. 5, 1913.

### Lamps and Lighting

*Incandescent-Lamp Manufacture.*—H. D. Erb.—The author comments on the very small margin of profit which can accrue to manufacturers of metal-filament lamps in view of the low level to which retail prices have now been reduced. The manufacture of low-voltage lamps is still much simpler than the manufacture of high-voltage types, and in view of the increasing demand for 14-volt (or other low-pressure) lamps for advertising and decorating work, it would probably pay some firms to specialize on low-voltage lamp manufacture. The problem of grading lamps for series operation has been solved well enough to permit of sign and other low-voltage lamps being run in series, but there is yet room for further improvement in this direction. The figures below summarize the manufacturing cost per thousand 220-volt, 25-watt lamps, as given by the author. These data are said to be drawn from actual factory records, and their arrangement shows how the value of the lamp increases as its manufacture proceeds, at what stage of its manufacture the greatest outlay in material and wages is required, the percentage of breakages in each stage, and the value of the pieces broken.

DATA ON LAMP-MANUFACTURING COST

| Item | Brought Forward* | Materials | Wages | Breakages | |
|---|---|---|---|---|---|
| | | | | Per Cent | Value |
| Bulb | ..... | $9.00 | $1.10 | 1.5 | $0.153 |
| Crown | ..... | 1.09 | 0.37 | 5.0 | 0.078 |
| Electrodes | ..... | 7.05 | 0.55 | 1.0 | 0.071 |
| Stem | ..... | 10.01 | 1.73 | 1.0 | 1.020 |
| Star | $11.80 | 6.40 | 3.20 | ... | 1.230 |
| Attachment | 21.40 | 32.40 | 7.80 | 2.0 | ..... |
| Melting on | 61.90 | 9.05 | 2.36 | 5.3 | 3.830 |
| Pumping | 73.00 | ..... | 2.87 | 6.0 | 4.680 |
| Flashing | 76.00 | 0.14 | 0.48 | 1.5 | 1.142 |
| Adjustment and completion | 76.50 | 5.30 | 2.27 | 2.0 | 1.680 |

*Cross total of cols. 2, 3 and 4 of previous line.

Up to a certain stage in manufacture, pieces are prepared which may subsequently be used in any one of a number of types of lamp, but beyond this stage parts are selected and assembled and true lamp manufacture commences. In the above table, no allowance is made for the cost of gas, electricity, standing charges and unproductive labor; in practice, these items should be reduced to a minimum. The figures in column 2 show the value per 1000 lamps of the materials in and wages spent on the lamps at various stages of their manufacture. As manufacture proceeds, the value of the piece handled during any particular operation increases rapidly since it becomes a complex structure, damage to which involves a greater wastage of time and material than is accounted for by the member actually broken.—From an article in *Elek. Anz.,* translated in abstract in London *Elec. Review,* Dec. 5, 1913.

### Generation, Transmission and Distribution

*Transformation of Two-Phase to Three-Phase.*—H. de Pistoye.—The first part of an article, illustrated by diagrams, on methods of transformation from two-phase to three-phase. Either a two-phase magnetic circuit may be used (Scott system) or a three-phase magnetic circuit (Leblanc system). In the present instalment the Scott system is discussed. The author explains its general principles, the special conditions which the transformers must fulfil, the utilization of the magnetic circuits in the Scott system, and, in the case of an unbalanced system, whether the neutral point is accessible or not. The article is to be concluded.—*La Lumière Elec.,* Nov. 29, 1913.

*High-Voltage Engineering.*—F. W. Peek, Jr.—A Franklin Institute paper discussing the general subject of high-voltage engineering under the following headings: the dielectric circuit, gaseous insulation (air; laws of corona losses), solid insulation, etc. In conclusion the author deals briefly with some special high-voltage problems like breakdowns caused by the addition of stronger insulation; the combination of insulations; occurrence of "static" and

"leakage" over insulation; dielectric flux control; dielectrics in multiple; effect of altitude on spark-over of insulation and bushings; methods of measuring high voltages; probable limits of voltage in transmission (possibly the whole country could be tied together at 200,000 volts); voltage regulation of transmission lines; high reactance in transformers; arcs and short-circuits, and high-voltage switching.—*Journal Franklin Inst.*, December, 1913.

**Traction**

*Electric Automobiles.*—F. W. MOOCK.—The first of an illustrated article on electric automobiles and gasoline-electric automobiles in Europe. The article is to be concluded.—*Elek. Zeit.*, Dec. 4, 1913.

*Electrical Equipment of Automobiles.*—C. E. WILSON.—An illustrated article on the electrical equipment of gasoline automobiles for ignition, lighting, starting, gear-shifting, etc., with detailed illustratons of typical apparatus.—*Elec. Journal*, December, 1913.

**Installations, Systems and Appliances**

*Improving the Power-Factor.*—R. NAGEL.—Finding that the power-factor of German central stations has decreased in recent years, the author urges that steps be taken to improve this condition and recommends that large energy users be allowed a discount on the basis of their mean annual power-factor. Such an inducement would lead them to operate their installations at as high power-factors as possible. In order to measure the mean annual power-factor the author recommends the use not of three-phase meters but of single-phase meters, connecting these so as to get the mean annual power-factor directly from the ratio of the readings of the two meters.—*Elek. Zeit.*, Dec. 4, 1913.

*Diversity Factor.*—An editorial on the fact that diversity factor is defined in different ways by different authors and authorities. According to the definition of the International Electrotechnical Commission, the diversity factor is a number obtained by dividing the sum of the maximum loads of the individual consumers supplied from a central station during a given period of time by the maximum load delivered from that station during the same period. The National Electric Light Association of the United States has adopted the inverse expression, and the London *Electrical Times* makes use of the latter value as a percentage. For instance, if the sum of the maximum loads of the individual consumers supplied from any plant during a given period of time is 200 kw and the maximum load delivered from that station during the same period is 100 kw, the diversity factor will be 2, 0.5 or 50 per cent, according to which of the three definitions just given is to be used. It is urged that universal support be given to the definition of the International Electrotechnical Commission.—London *Electrician*, Dec. 5, 1913.

*Phase-Balancer for Single-Phase Loads on Polyphase Systems.*—E. F. W. ALEXANDERSON.—The demands for single-phase energy from polyphase systems often reach such a point as to produce serious heating of the generators and troublesome unbalancing of the voltage. Especially is this true when single-phase energy is supplied for traction purposes or for electric furnaces. The author describes a machine that has been developed to counteract these undesirable influences. Its function is to absorb the unbalanced component of the load and to redistribute it to give a resultant balanced polyphase load. The phase-balancer consists essentially of a synchronous condenser provided with a polyphase booster connected in series with it, but in such a manner that its phase rotation is in the opposite direction to that of the synchronous condenser.—*Gen. Elec. Review*, December, 1913.

*Breaking Capacities of Oil Switches.*—S. FERGUSON.—An illustrated article in which the conditions arising on short-circuit and the action of oil switches are first briefly reviewed, after which the causes of explosions in oil switches are stated. An analysis of the results of tests on breaking capacities is given, and the factors governing breaking capacities of oil switches are considered. In conclusion the author deals with the rating, the selection and the location of oil switches.—London *Electrician*, Dec. 5, 1913.

**Electrophysics and Magnetism**

*Distribution of Energy in the Spectra of Gases.*—H. L. P. JOLLY.—An account of an experimental investigation of the manner in which the energy distribution among the lines of a bright-line spectrum varies when the intensity of excitation is changed. If the current in a discharge tube be small, the radiation from it is proportional to the current density, both for the whole spectrum and for any portion of it. In heavy discharges, such as that produced by a large condenser in parallel with the discharge tube, there is strong evidence that the energy shifts toward the longer wave-lengths when the current density increases. Whether the energy of any portion of the spectrum increases at a rate greater or smaller than the current has not been determined, owing to the difficulties in the way of measuring these currents. When the pressure at which a condensed discharge is sent through the tube is increased the energy shifts toward the longer wave-lengths. A continuous spectrum makes its appearance in these discharges and becomes more marked the higher the pressure.—*Philos. Mag.*, November, 1913.

*Constitution of Atoms and Molecules.*—N. BOHR.—A theoretical paper in which an attempt is made to develop a theory of the constitution of atoms and molecules on the basis of the ideas which Planck introduced to account for the radiation from a black body, and the theory of the structure of atoms which Rutherford proposed to explain the scattering of alpha particles by matter. Planck's theory deals with the emission and absorption of radiation from an atomic vibrator of a constant frequency, independent of the amount of energy possessed by the system at the moment considered. The assumption of such vibrators, however, involves the assumption of quasi-elastic forces and is inconsistent with Rutherford's theory, according to which all the forces between the particles of an atomic system vary inversely as the square of the distance separating them. In order to apply the main results obtained by Planck, it is therefore necessary to introduce new assumptions concerning the emission and absorption of radiation by an atomic system. The main assumptions made in the present paper are: (1) That energy radiation is not emitted (or absorbed) in the continuous way assumed in ordinary electrodynamics, but only during the passing of the systems between different "stationary" states; (2) that the dynamical equilibrium of the systems in the stationary states is governed by the ordinary laws of mechanics, while these laws do not hold for the passing of the systems between the different stationary states; (3) that the radiation emitted during the transition of a system between two stationary states is homogeneous, and that the relation between the frequency $\nu$ and the total amount of energy emitted $E$ is given by $E = h\nu$, where $h$ is Planck's constant; (4) that the different stationary states of a simple system consisting of an electron rotating round a positive nucleus are determined by the condition that the ratio between the total energy emitted during the formation of the configuration and the frequency of revolution of the electron is an entire multiple of $h/2$; (5) that the "permanent" state of any atomic system—that is, the state in which the energy emitted is maximum—is determined by the condition that the angular momentum of every electron round the center of its orbit is equal to $h/2$. It is shown that, applying these assumptions to Rutherford's atom model, it is possible to account for the laws of Balmer and Rydberg connecting the frequency of the different lines in the line spectrum of an element. Further, outlines are given of a theory of the

constitution of the atoms of the elements and of the formation of molecules of chemical combinations, which on several points is shown to be in approximate agreement with experiments.—*Philos. Mag.*, November, 1913.

**Units, Measurements and Instruments**

*Insulation Resistance.*—S. Evershed.—The conclusion of his paper read before the (British) Institution of Electrical Engineers. The author discusses the laws of the moisture curve. The experiments on absorbent insulators suggest that underlying the phenomena there is some ascertainable law of conduction by moisture. The fact that it is possible to compare one curve with another without taking the potential gradient in the insulator into account is sufficient proof that the curves have some simple property in common. In fact, in every case in which moisture conduction alone controls the resistance curve it is found that over a considerable length along the curve the ratio $R_v : R_{10v}$ ($R_v$ and $R_{10v}$ being the insulation resistances at $v$ and $10v$ volts respectively) is fairly constant whatever may be the value of $v$ in volts. Hence, although the insulators may vary widely in thickness, the ratio $R50 : R500$ serves quite well as a rough guide for comparing the different curves. The law is expressed empirically by the formula

$$R = k\left(\frac{1}{v}\right)^{\frac{1}{x}}$$

and in each particular case a value may be chosen for $x$ which will express the law of the individual curve over a great part of its length, and hence when the ratio $R_v : R_{10}v$ has been found by experiment, the formula may be found to ascertain any other ratio $R_v : R_{nv}$ for values of $n$ lying between 1 and 10. The author of the paper then proceeds to discuss "compound insulation," consisting of a non-absorbent dielectric insulator in series with an absorbent insulator. While for absorbent insulators the ratio $R_v : R_{10}v$ is 2.2 on the average, the same ratio has a mean value of a little less than 1.4 for absorbent insulators. The author finally discusses the properties of a model insulator.—London *Electrician*, Dec. 5, 1913.

*Electrostatic Oscillograph.*—H. Ho and S. Koto.—An abstract of a (British) Physical Society paper. The general arrangement is shown in Fig. 1, in which the potential difference between $a_0$ and $b_0$ is required to be recorded. $C$ is an oil condenser, to be used, if necessary, for reducing the above voltage to a suitable value at the terminals $a\,b$ of the oscillograph. Two bronze strips, $s_1$ and $s_2$, are stretched between two parallel metallic plates, $F_1$ and $F_2$, called "field plates." These strips are parallel to one another and to the plates and carry a small mirror $m$ in the center, the tension being adjustable in the manner usually adopted. Contrary to the method used in an ordinary oscillograph, the strips are insulated from each other by a silk thread $t$, which connects them and passes over an ivory pulley $p$, thus forming two electrically independent

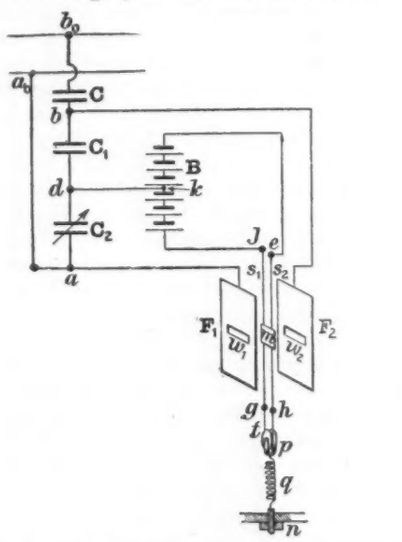



FIG. 1—GENERAL ARRANGEMENT OF ELECTROSTATIC OSCILLOGRAPH

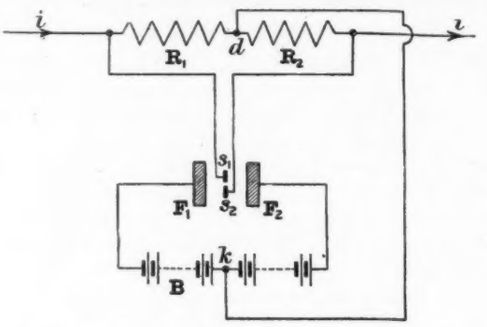



FIG. 2—CONNECTIONS FOR RECORDING SMALL CURRENTS

conductors in the electric field of the parallel-plate condenser $F_1$, $F_2$. The plate $F_1$ has an opening $w_1$ for the passage of the light ray to and from the mirror, and an exactly similar opening is cut on the other plate, $F_2$, to maintain the symmetry of the electric field. The plates and the strips mounted on an ebonite frame complete the vibrator, which is immersed in an oil bath provided with the necessary number of terminals with suitable insulating bushings for the pressure to be employed. Two oil condensers, $C_1$ and $C_2$ in series, are connected to the points $a\,b$, in multiple with the field plates as in Fig. 1. One of these condensers must, however, be adjustable. $B$ represents a number of small dry cells, connected in series and mounted on an insulating stand, the electrical center $k$ of this battery being connected to the point $d$ between $C_1$ and $C_2$. Its terminals are connected to the two strips $s_1$, $s_2$ in order to charge them for the same purpose as the needle of a quadrant electrometer is charged. Oil plays a very important part in this oscillograph, since it serves as the damping agent and as the insulator. Its high specific inductive capacity increases the sensitiveness. In order to record very small currents, the connections of Fig 2 may be used, in which $R_1$ and $R_2$ are two exactly equal resistances with as little inductance and capacity as possible, connected in series in the circuit of the current to be recorded, the middle point $d$ being connected to $k$, the center point of emf of the high-tension battery $B$.—London *Electrician*, Nov. 21, 1913.

*Bismuth Thermopiles.*—W. W. Coblentz.—The author first discusses the relation between external and internal resistance. The older theories held that the maximum efficiency is attained when the external (the galvanometer) resistance is the same as the (internal) resistance of the thermopile. But this has recently been questioned. The problem was subjected by the author to a test with a thermopile having a resistance of 6.8 ohms. When the external resistance was four times (i. e., 26 ohms) that of the thermopile, the radiation sensitivity was 16.4 to 17 per cent less than when the external resistance (6.5 ohms) was the same as the internal (thermopile) resistance. In view of the facts that there was a loss of only 16.5 per cent in efficiency when the external resistance was four times the internal resistance, and also that one rarely meets with conditions where the galvanometer resistance is more than twice the resistance of the thermopile, it is evident that this question proves to be of minor importance. The author then discusses critically the several factors which determine the radiation sensitivity of a thermopile. In the case of eight samples of bismuth wire tested (diameters 0.06, 0.08, 0.1 and 0.15 mm), the thermoelectric emf against

silver varied from 75 to 82 microvolts. This function seems to depend on the purity of the material. Some experiments were also made with different bismuth alloys.—*Journal Franklin Inst.*, December, 1913.

*Precision Pendulum.*—K. SIEGEL.—The author has previously described the use of electrolytic condensers to prevent sparking at the contacts in the operation of electric clocks. For such installations electrolytic condensers consisting of nickel electrodes in caustic potash solution have proved satisfactory in practice. In the present illustrated article the author describes a precision pendulum in which electrolytic condensers are also used for preventing sparking at the contacts. An additional feature of this pendulum is the fact that the driving force of the pendulum is absolutely independent of the electric current.—*Elek. Zeit.*, Dec. 4, 1913.

*Resistors of Very High Resistance.*—NORMAN CAMPBELL.—An article giving further data on resistors of very high resistance made of mixtures of xylol and alcohol contained in glass cells, with hints as to the practical construction of such resistors. The resistance of the cells made by the author varies between $10^8$ and $10^{12}$ ohms.—*Philos. Mag.*, December, 1913.

*Watt-Hour Meters.*—An account of the discussion at Birmingham which followed the reading of the paper by Holden recommending modifications for the British standard specification of consumers' watt-hour meters.—London *Electrician*, Nov. 28, 1913.

### Telegraphy, Telephony and Signals

*Cable Systems of the World.*—MAX ROSCHER.—A statistical article, with numerous tables, covering the development of the cable systems of the world from 1898 to 1913. The total cable length installed in the world was 318,026 km in 1898, 412,032 km in 1903, 464,852 km in 1908, and 519,347 km in 1913. Of this mileage 93,486 km was owned by governments and 425,861 was owned by private companies. Great Britain owns 281,828 km, the United States 100,831 km, France 43,680 km, Germany 43,294 km, and Denmark 17,516 km. Japan, Holland, Spain and Italy follow, each with less than 10,000 km.—*Elek. Zeit.*, Nov. 27, 1913.

*Single-Phase Traction and Telephony.*—G. GIROUSSE.—The first part of an article in which the author discusses the troubles caused in telephone lines by single-phase traction lines in the neighborhood affecting either the operation of the apparatus or the safety of persons. Remedies for these troubles are outlined. The article is to be continued.—*La Lumière Elec.*, Nov. 29, 1913.

*Gott System of Telegraphy.*—HEINRICH DREISBACH.—An illustrated article on the Gott system adopted by the (British) Commercial Cable Company for increasing the speed of cable telegraphy by using successive impulses of opposite signs (as has been described in detail in these columns). Much larger batteries must, however, be used if the advantages of the new system are to be obtained. In any cable of medium length operated on the Wheatstone, Hughes or other system the Gott method permits a certain moderate increase of the speed of telegraphy.—*Elek. Zeit.*, Dec. 4, 1913.

*Locomotive Signals.*—An illustrated article on a system of automatic audible electric signals for locomotives in use on a British railroad.—London *Electrician*, Dec. 5, 1913.

### Miscellaneous

*Association of German Central Stations.*—A report of the thirty-second general convention of the German Association of Central Stations, held last summer at Trier. The attendance was 300. The number of central stations represented in the association is 507, of which 119 are outside of Germany. Papers were read by Schulte on theory and practice in the statistics of central stations, by Passavant on accident liability of central stations, by Wikander on the business policy of central stations and methods of increasing energy consumption, by Steinmueller on boilers for electric-lighting stations, by Henney on aluminum transmission lines, and by Matthias on limiting devices for keeping the watt consumption of consumers below a predescribed maximum.—*Elek. Kraftbet. u. Bahnen*, Nov. 24, 1913.

*Japan.*—A. A. BRANDT.—A statistical article on Japanese electric undertakings in 1912. The total number of workingmen in Japan is 793,885, of which number only 3300 are employed in electrical factories. Installation material, wires and incandescent lamps are made in Japan, as there is a prohibitive import tariff. The wages of the workingmen have increased by 50 per cent to 75 per cent since 1900. The number of electric-lighting companies was 155 in 1911, against 122 in 1910. The number of electric railways was forty-seven in 1912, with 558 miles in operation and 200 miles in course of equipment. In 1911-12 there were 4657 telegraph stations and 1958 public telephone stations.—*Elek. Zeit.*, Nov. 27, 1913.

*Ghent.*—J. REYVAL.—The first part of an article on generating sets and the Ghent exhibition. The present instalment gives details of a 1000-hp four-cylinder Carels-Diesel oil engine which drives a 600-kw alternator.—*La Lumière Elec.*, Nov. 8, 1913.

*Young Electrical Engineers.*—A long editorial on the prospects of the young electrical engineer in Great Britain.—London *Electrician*, Nov. 14, 1913.

# Book Reviews

THE POLYTECHNIC ENGINEER. Published annually by the students of the Polytechnic Institute of Brooklyn. 138 pages, illus. Price, $1.25.

A number of short papers are printed in this year's volume. Some of them appear to possess considerable merit and originality. They also bear the evidence of having been carefully edited. The following is a list of the papers and theses, excluding editorials and regular formal announcements: History of bridge building; thickness of films of silver upon glass; oscillation transformers; lattice bars; the industries of Detroit; the vector diagrams of electric discharges; senior inspection trip; diffusion of light by mechanical means; blue and iridescent gelatine-copper; the Pitot tube; Chinese wood oil; engineering education in America; résumé of the lectures of Sir William Ramsay; predetermination of voltage; regulation in alternators. An excellent photographic portrait of Prof. Samuel Sheldon appears on the opening page.

ACUMULADORES ELÉCTRICOS. By Gaston Ossa. Santiago, Chili: Sociedad Imprenta y Litografia Universo. 103 pages, illus. Price, 7 francs.

A good practical work on electric storage batteries of both the lead and steel types, and one of the very few books on the subject printed in Spanish. The author mentions in his excellent preface the difficulty encountered in finding information in Chili upon the subject of the installation, maintenance and testing of storage batteries except in books of reference written in foreign languages. He therefore decided to collect this material, guided by his own practical experience on the subject, and to publish the collection in book form. The eight chapters of the book relate to the following topics, after the introduction: General principles; electrodes; the electrolyte; installation; operation and tests; causes, symptoms and remedies for troubles; principal applications and connections with lighting networks; predetermination of a battery for a stated service, and the alkaline storage battery. A good bibliography and an index are appended. The book is much the best on the subject we have yet seen in Spanish. Some of the illustrations might be improved in the next edition. The description is clear and straight to the point from the standpoint of the engineer.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Fire Extinguisher

The fire extinguisher shown in the accompanying illustration operates by means of self-contained compressed air, no mechanical force being necessary. Carbon tetrachloride is the basis of the extinguishing fluid used. The turning of an outlet valve with the device in an upright position will cause the fluid to flow out, and it can be aimed accurately at any desired spot. The extinguisher is designed to throw a spray as well as a stream, the former going a distance of 10 ft. and the latter 25 ft. The spray is most effective on small fires scattered over a comparatively large area; the stream is usually best for small fires concentrated in one spot.

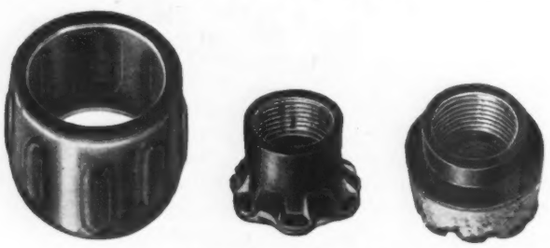
FIRE EXTINGUISHER

This extinguisher, which is known as the "J-M Fyro," consists of only ten working parts. It is made of heavy seamless brass, is cylindrical in form, measures 15 in. high by 3 in. in diameter, and weighs 5 lb. At the top is the valve through which the extinguishing fluid is discharged. Running through the center from the outlet valve almost to the bottom is a siphon tube. The air pressure forces the carbon tetrachloride up this tube and it is said to hold it permanently against the outlet valve, thus forming "liquid seal," which prevents any leakage of air pressure. The extinguisher has a capacity of 7 qt.

The "J-M Fyro" extinguisher is manufactured by the H. W. Johns-Manville, Company, New York.

### Drawn-Steel Pipe Insulators

The insulating couplings shown herewith are called "insulating joints" in the fixture trade. Fixtures of this type were originally made of cast iron or brass, then of malleable iron, and now those illustrated are made of drawn steel. Fig. 1 represents a drawn-steel shell inwardly flanged and corrugated to afford a grip for pipe-tongs or wrench. Fig. 2 shows a drawn-steel thimble consisting of a threaded cap with a "pie-crust" fluted flange.



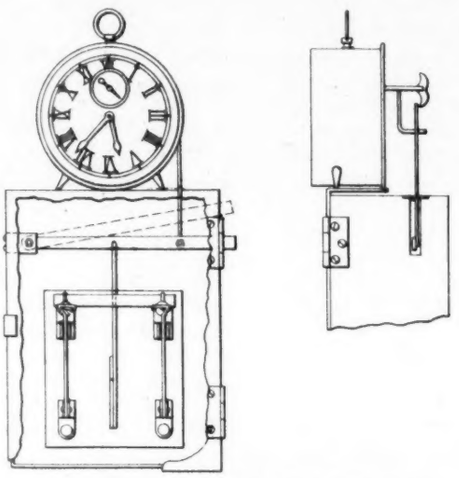
FIGS. 1, 2 AND 3—DRAWN-STEEL SHELL AND THIMBLE, AND THIMBLE AFTER BREAK

Fig. 3 shows a drawn-steel thimble broken in a test. The specimen was pulled apart by the shearing of the insulation. A 0.375-in. pipe size carried under test a straight pull of 8000 lb. before breaking. These fixtures are provided with double insulation and will withstand a test at either end of 4000 volts, alternating current, for five minutes, according to the Underwriters' specifications. The insulation is of the nature of artificial stone, being molded in place and subsequently hardened, and it has been named "Di-el-ite."

These insulating couplings are the product of the Wirt Company, Germantown, Pa.

### Alarm-Clock Time-Switch for Window and Sign Circuits

An inexpensive time switch for extinguishing or lighting window displays or electric signs has recently been put on the market by Mr. Victor G. Jensen, 1105 East Sixty-third Street, Chicago. This device, as shown on the accompanying sketches, consists of a standard cabinet knock-out box 6 in. wide by 8 in. high by 3.5 in. deep. On a slate base in this box are mounted a double-pole single-throw switch and a safety-pin spring made of cold-drawn steel. The spring engages a lever which in turn engages the alarm winding key. To set the time switch, the spring is first depressed, being held in that position by the lever. This allows the switch to be closed without touching the spring. At the predetermined hour the operation of the alarm mechanism revolves the key crank and raises the lever, disengaging the spring. This spring strikes the double-pole single-throw switch a heavy blow, opening it sharply. To turn on lamps the spring may be reversed in the time switch.

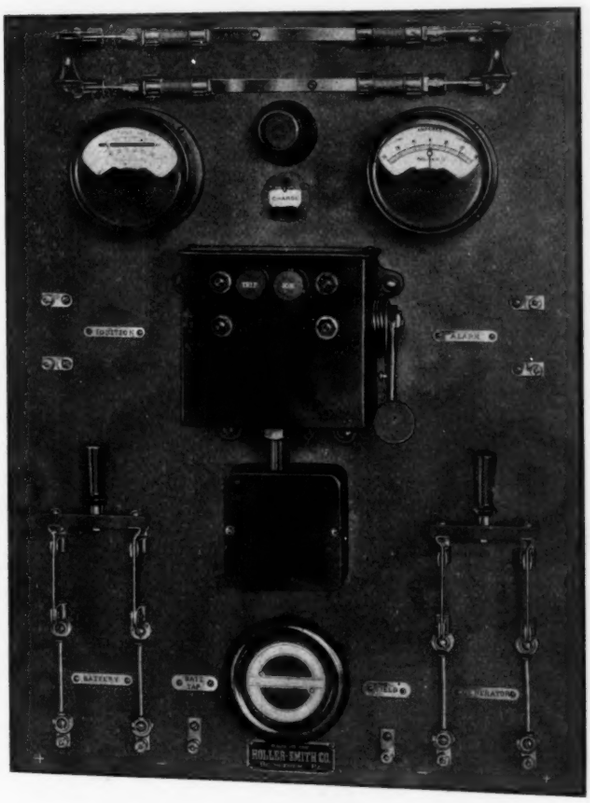


ALARM-CLOCK-OPERATED SWITCH FOR SIGN AND SHOW-WINDOW CIRCUIT

The cabinet boxes are made by the George Cutter Company, South Bend, Ind., the switches by the Trumbull Electric Manufacturing Company, Plainville, Conn., and the clocks by the Ansonia Clock Company. The standard switch here described is designed to carry 30 amp at 250 volts, but the boxes may be furnished with switches of any size varying from 3 amp to 200 amp. A pull of but 1 oz. releases the spring, although the latter strikes the switch with a force of from 6 lb. to 10 lb. Aside from the clock, the switch has but three moving parts, all of which are readily accessible.

## Automatic Charging and Lighting Panel

A simple automatic charging and lighting panel for small isolated plants using oil or gasoline engines has been designed by the Roller-Smith Company, 203 Broadway, New York. By its use the charge is delivered to the battery at the most desirable tapered rate, being heavy at the start and gradually reducing to a low rate at the finish so as to



AUTOMATIC CHARGING PANEL

avoid overheating, injurious gassing or spraying and injury to the battery plates. Long life and maximum efficiency of the battery are thus assured. The control described is accomplished without any adjustment or supervision after the charge is started.

The panel, illustrated herewith, is equipped with black-enameled instruments mounted on a natural black-slate base supported on angle-iron frames. At the right near the top is a battery ammeter with a double scale, indicating the amount of charge or discharge current. At the left is a voltage relay identical in appearance with the ammeter. This has two platinum contact-making pins, one of which, on completion of a charge, makes contact with the needle of the relay, causing an automatic circuit-breaker and a throw-over switch to open and stop the charge, at the same time breaking the ignition circuit of the gas engine so that the latter also stops. The circuit-breaker connects the lamp circuit direct to the battery at the same instant the dynamo is disconnected, so that there will be no interruption at the lamps. The other platinum pin of the relay makes contact when the battery is discharged, operating a drop which is the signal to recharge. The volt relay is also a voltmeter, showing on its scale the voltage of the battery during charge and discharge. A pilot lamp, which is automatically connected during charge, illuminates the instrument dials.

Below the instruments is the automatic switch or circuit-breaker inclosed in a black-enameled iron case and operating in oil. A shunt trip coil for releasing this circuit-breaker is inclosed in the case. This oil switch makes all necessary operating connections and no handling of the knife switches is required. Pushing the button on its handle completely down makes connections from the battery to the dynamo for starting, and as soon as the engine begins to run and the ammeter shows that the current is changed from "discharge" to "charge," the handle may be released. The switch is then in the charging position, where it will ordinarily remain until the completion of the charge. A hand trip button is provided on this switch so that it can be opened at will, and a combined overload and reverse-current relay is situated just below the switch, opening it in case of overload or if the engine slows down or stops, which would cause the battery to discharge back into the generator.

## Flame-Arc Lamp for Long-Hour Burning

The Electro Development Company of New York City is putting on the market a long-burning inclosed flame-arc lamp which, it is stated, will operate for 200 hours on a single trim. The floating feed mechanism of the lamp is controlled by a single series solenoid, which advances the lower electrode, a 9-in. by 1-in. treated carbon. The upper electrode is a 2-in. by 2.5-in. piece of untreated carbon and for direct-current operation is connected to the negative side of the line. In order that this large piece of carbon shall not be burned away more rapidly on one side than on the other a ratchet has been arranged to revolve it by small increments as the side on which the arc is burning becomes lower than the surrounding parts. The use of this short heavy piece of carbon also does away with the necessity of allowing the upper electrode to protrude into the mechanism of the lamp. No economizers or blow magnets are used with the carbons. The size of the upper electrode keeps the arc in nearly the same horizontal plane throughout its life, which is between 400 and 600 hours, so that the lamp is really of the focusing type although without

LONG-BURNING INCLOSED ARC LAMP

focusing apparatus. It is declared that the lamp will operate without flicker throughout each entire trim.

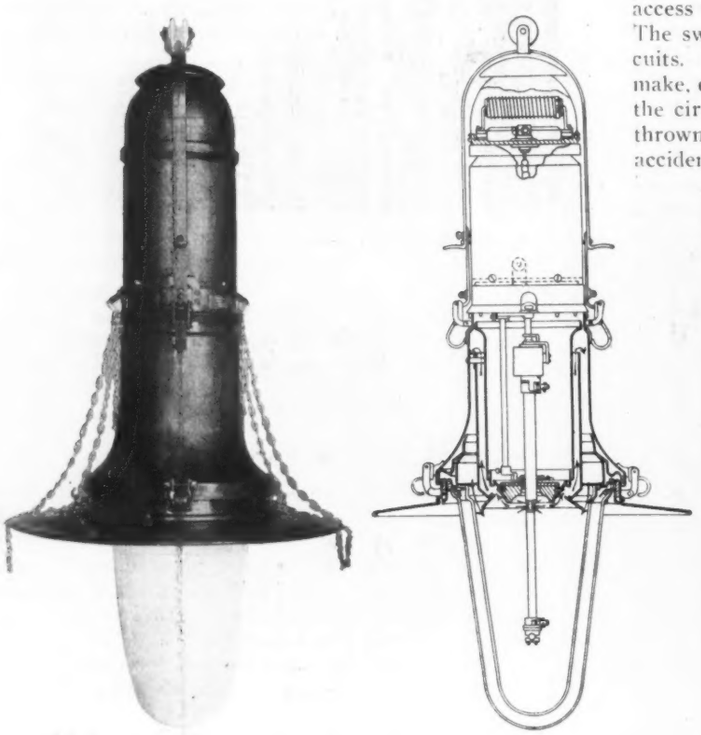
On direct-current multiple circuits the lamp requires 5 amp with 80 volts at the arc, while the alternating-current lamp takes 7 amp with 78 volts at the arc. Series lamps of this type are also manufactured. All of these lamps are equipped with an improved condensing chamber made of a case of solid copper having a gun-metal outside finish.

## Long-Burning Inclosed Flaming-Arc Lamp

The 100-hour inclosed flaming-arc lamp shown in the accompanying illustrations is of the Siemens type, of which the H. M. Hirschberg Company, 39 East Twentieth Street, New York City, is the sole importer. While the unit shown is of the direct-current type, these lamps are also furnished for operation two in series on 110 volts, either direct or alternating current. An alternating-current multiple lamp with inclosed choke coil for use on 110-volt circuits is also available.

As the drawing shows, this long-burning direct-current lamp is of the differential type, with vertical carbons and inclosed arc chamber. The regulating mechanism is contained in the housing at the top; by loosening four screws the upper internal cap may be removed, thus giving access to the regulating resistor. Adjustment is made by means of the several screws shown. These make connection with the lead wires, which pass through a porcelain insulator. The lamp housing has two porcelain bushings for the binding posts inside the casing. The connections are seated in sturdy porcelain parts which insure good insulation.

Side supports of the frame serve as guides for the movement of the upper electrode. The beaded conductors for both the upper and lower electrodes lie in the upper part of the central chamber, but outside of the combustion chamber, so that they cannot be attacked by the products of combustion given off during the operation of the arc. Moving conductors in the combustion chamber are thus completely avoided.



FIGS. 1 AND 2—INCLOSED FLAMING-ARC LAMP

The chamber surrounding the feed mechanism consists of an outer and an inner casing and an outer and an inner globe. These outer and inner casings are fastened together at the top, while the whole armature section is supported from the upper casing by eccentric clutches. By means of the hollow cylindrical construction shown the space between the outer and inner casings is divided into two circular channels. A bayonet-joint construction connects the inner casing with the cylinder so that the casing can be easily removed. At its lower end the cylinder supports a reflector which serves to direct downward all light given off above the horizontal, making it available as useful illumination.

The gases produced during combustion are conducted upward through the annular opening surrounding the arc, rising through this cylindrical chamber and then passing down again between the partition and the outer casing. After following the path shown by the arrows, they finally again enter the inner globe in a purified state. During the course of this circulation the gases are cooled and the products of combustion are deposited on the walls of the circulation chambers. Any material that chances to come over is dropped into the lowest part of the inner globe, thus assuring at all times cleanliness and transparency in those parts of the glass through which light is transmitted.

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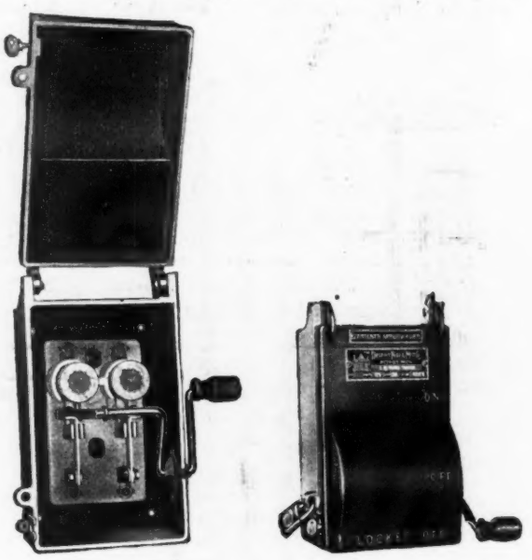
## Ironclad Entrance Switch

The Detroit Fuse & Manufacturing Company has designed an ironclad switch for entrance work which has the live metal parts inclosed in a housing so as to give both safety to the operator and protection to property. At the same time it provides means, outside the housing, for the safe operation of the switching mechanism. The switch, which is illustrated herewith, is inclosed in a cast-iron box and is operated from the outside. The cover of the box is designed so that it will close by gravity. The box may be sealed to prevent unauthorized persons gaining access to the fuses and the live metal parts of the switch. The switch is made for both two-wire and three-wire circuits. A spring device is provided for making a "positive-make, quick-break" action. This device automatically opens the circuit if good contact is not made when the switch is thrown "on." There is no possibility of the switch opening accidentally, however, when good contact is made. The handle can be made detachable. This handle is so constructed that when placed on the operating shaft it will indicate the position of the interior mechanism the same as is done by a fixed lever.



FIGS. 1 AND 2—IRONCLAD SWITCH, OPEN AND CLOSED

The switch may be locked "off" by the use of a padlock, making it impossible to operate the switch until the lock has been removed. With such a switch in use, it is not necessary, therefore, for central stations to remove meters and connections in apartments or other rented properties every time they are vacated. Fig. 2 shows the box closed and equipped with a padlock.

Although this switch is designed primarily for entrance work, it may be used for other kinds of installations where an inclosed switch is desirable.

## Water Purification by Ozone in Large Office Building

An interesting mechanical and electrical equipment for water purification is in service in the recently erected office building of the Chicago, Burlington & Quincy Railroad Company in Chicago. The water used for drinking purposes, which is obtained from Lake Michigan through the city mains, is first clarified by being passed through three sand filters and one paper filter, after which ozone is applied to sterilize it.

This ozone is produced by two generators manufactured by the Held Company, Chicago, Ill., and is mixed with the water by a patented process developed by the same company. Each ozone generator contains ten tubes, an ozone-tube unit consisting of a vacuum tube, which contains an electrode, and an outer tube in which the vacuum tube is placed. This outer tube has a covering that acts an an electrode. Alternating current at 5500 volts is passed through the ozone tubes, and the action of the discharge in these tubes breaks up the oxygen molecules and produces the ozone. The construction of the tubes is such that there is no sparking or arcing, and the manufacturer declares that no nitrous oxide is formed when the ozone is generated.

Water enters the mixing device from the top and is then broken up into a fine spray. The ozone as generated is pumped to a mixer and is brought into contact with the water three different times. The water comes out in a continuous stream as it entered.

The action of the ozone coming into contact with disease-producing bacteria in water is asserted to be something like that which happens when fire and gunpowder are brought together, the ozone "burning" the carbon in the bacteria into carbonic acid, which passes out of the water in the form of bubbles, leaving no residue. This method of sterilizing, it is stated, does not affect the original mineral properties of

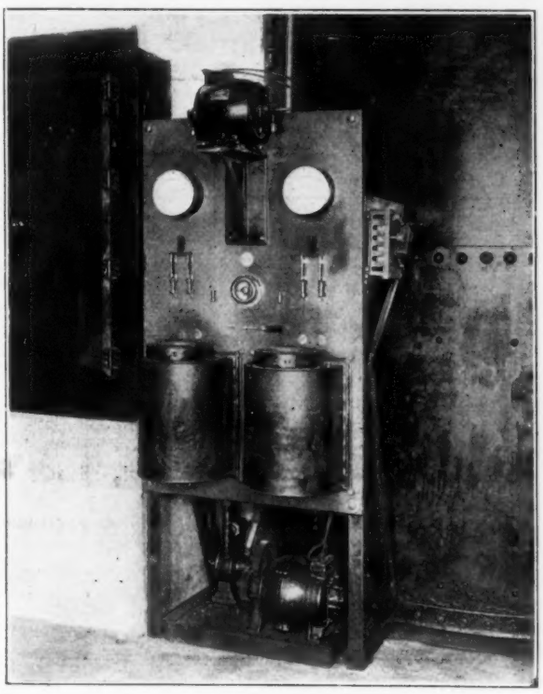


FIG. 1—ELECTRICAL EQUIPMENT FOR OZONE INSTALLATION

the water and leaves it clear, sparkling and sterile. The manufacturer says that the cost of treating 700 gal. of water by this method is less than 1 cent for the actual electrical energy necessary.

Fig. 1 shows part of the electrical equipment of the installation referred to. The motor-generator at the top of the switchboard changes the direct current of the building mains to alternating current. This is raised to 5500 volts in a transformer on the back of the board. At this voltage the energy goes through the two ozone generators attached to the front of the board. Below the switchboard is an electrically driven air pump which forces air through the ozone generators. The ozone passes through a pipe to the bottom of the mixer, shown above the large tank at the

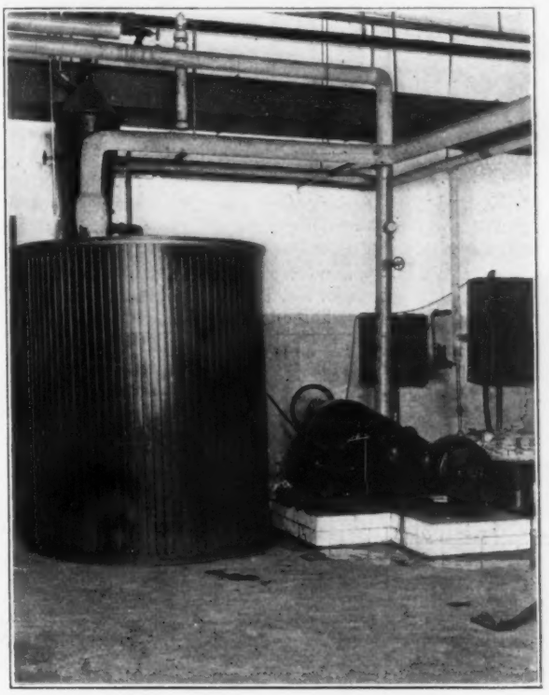


FIG. 2—TANK AND PUMPING EQUIPMENT

left in Fig. 2. The water is introduced at the top of the mixer. It comes from the filters shown at the right in Fig. 2 near the electrically driven circulating pump. The tank contains the storage supply of filtered and ozonized water.

## Electric Trucks for Parcels-Post Service

To make parcel-post deliveries with the greatest efficiency and lowest possible cost the United States Post Office Department has been conducting experiments with different kinds of vehicles. For the past ten months the post office at Indianapolis has employed two gasoline cars and two Waverley electric vehicles in this service. On Sept. 1 a third Waverley was installed, and since then the use of the two gasoline cars has been discontinued.

A comparison of the average daily results from the two

COMPARISON BETWEEN GASOLINE AND ELECTRIC TRUCKS IN PARCELS-POST SERVICE

| | Gasoline | Electric |
|---|---|---|
| Total number of parcels delivered per car | 136.5 | 271.5 |
| Stops made | 135 | 189 |
| Mileage | 45.6 | 18.75 |
| Time, hours | 8.5 | 7.035 |
| Cost | $8.50 | $5.60 |
| Cost per parcel | $0.0623 | $0.02062 |
| Cost per stop | $0.0930 | $0.0326 |
| Cost per parcel-mile | $0.00137 | $0.0011 |
| Stops per mile | 2.96 | 6.02 |

methods of delivery is given in the table, from which it will be seen that the cost per parcel-mile with the gasoline cars was 25 per cent higher than with the electric vehicles, and this fact had much to do with abandoning the use of gas cars in this service.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Addition to Manufacturing Plant of National Carbon Company.**—The National Carbon Company, of Cleveland, Ohio, is building an addition to its Jersey City (N. J.) manufacturing plant. The increased business in the East, as well as the larger export trade which it is handling from New York and the feeling that Atlantic Coast customers should have the benefit of prompt deliveries, made necessary the new plant. With the new building, the Jersey City works will be the largest battery-manufacturing plant in the East. The building is at the present time under cover, and all contracts have been placed, so that work on it is progressing rapidly.

**Pipe Manufacturer Enters the Lighting Post Field.**—The Central Foundry Company, 90 West Street, New York, large manufacturer of piping, valve boxes and other power-plant accessory equipment, has been developing for some time a line of arc and incandescent lamp-posts and lighting standards of cast iron, for use by central stations and municipalities in ornamental street-lighting work. Installations of these posts have already been made in the East. The Central Foundry Company has had a long experience in the manufacture and handling of cast iron and has foundries, warehouses and branch offices in over a dozen cities throughout the United States.

**Bankruptcy of the D. L. Bates & Brothers Company.**—Mr. W. S. McConnaughey, referee in bankruptcy, has notified the creditors of the D. L. Bates & Brothers Company, of Dayton, Ohio, bankrupt, that the trustee has filed an application for an order to sell the goods of the company at the office of the referee, 605 Citizens' National Bank Building, Dayton, on Dec. 29 at 2 p. m. The trustee requests that sealed bids be asked for the goods of the bankrupt company, either in parcels or as a whole, and that the bidders have the privilege of raising their bids orally, if desired, at the time of sale. This application for an order of sale will come up for hearing before the referee on Dec. 29 at 9 a. m.

**Expansion of Electric Service in the South.**—Manufacturers of electrical equipment state that the outlook for business in the Central South is excellent, owing to the large number of electric-light plants to be built in towns and villages in the farming districts. "The South is an agricultural community," said the sales manager of a leading manufacturing concern, "and good prices for cotton have made that section prosperous. The establishment of electric-light plants in country towns all over the South is going forward at a rapid rate, and I do not look for these improvements to be interfered with by the tight money market or the business uncertainty which is hampering trade in some other parts of the country."

**Terry Turbo-Generator Set Used to Operate Lifting Magnet.**—To eliminate the necessity of dragging power wires along the track on which locomotive cranes using electromagnets work back and forth, experiments have been made in the way of fitting these cranes with small engine-driven generator sets to furnish current for the magnet. The trouble experienced with reciprocating sets has led to the use of small turbo-generator sets. Such an application has been made by the Brown Hoisting Machinery Company on a 15-ton crane with a 40-ft. boom, using a 5-kw Terry turbo-generator set built by the Terry Steam Turbine Company, of Hartford, Conn. The magnet, energized by current from this unit, is used for handling pig iron and scrap at any point within the reach of the boom. The crane is moved by a reciprocating engine in the usual way, and the swinging and elevation of the boom are taken care of in a similar manner. The generator set is installed in a small compartment beneath the floor of the operator's cab, where it is entirely out of the way. Fitted with sight-feed lubricators, the bearings are kept flooded with oil.

**Pro and Con of the Fixed-Price Question.**—Quite a lively discussion was drawn forth at the recent convention of the National Civic Federation, in a session devoted to the subject of regulation of industrial corporations, by the presenting of different sides of the "fixed-price" question. W. H. Ingersoll, of the American Fair Trade League, stated that it is a common thing for retailers who have stocks of goods of poor quality which they wish to sell to buy limited stocks of high-grade, well-known products and advertise their sale at ridiculously low prices simply to draw crowds, who are expected incidentally to buy up the other stocks of inferior goods while on the premises. The whole strength of this plan lies in the quality and reputation of the goods on which the price is cut, and Mr. Ingersoll explained how the operation of the above scheme works to the detriment of these high-grade goods. First there is a rush to get the article at the large reduction; then the public begins to ask why it should pay the regular price, if the article can be sold at a much lower figure, and refuses to buy it at its original price. The sale of the article at a cut price cannot be permanently continued, since it involves a loss to the dealer, so finally its sale in the community stops altogether. Mr. Ingersoll favored the fixing of prices on high-grade goods. Against fixed prices were E. W. Bloomingdale, counsel for the Retail Dry Goods Association, and E. E. Wise, who won the recent case before the Supreme Court of the United States in which R. H. Macy & Company were upheld in their right to sell copyrighted books below their list prices. The substance of the arguments presented by Messrs. Bloomingdale and Wise was that a fixed price need not have any relation at all to the actual value of the article on which it is placed, and, as retailers are primarily concerned with values, they should not be placed where the manufacturer of any article can dictate absolutely its terms of sale, regardless of the factor of actual value. It was argued that if price fixing is allowed on articles of big reputation and high grade it will inevitably be extended to cover or include all goods. The contentions of both parties are excellent and worthy to form parts of a single argument. They do not interfere in any way. The solution of the whole problem seems to lie in a determination of the actual value of goods and the fixing of a fair price below which they cannot be sold. Incidentally the interests of the manufacturer, dealer and consumer will all be advanced if the price set is low enough to give a fair profit and at the same time reach the largest possible buying field.

**Large Electric Vehicle Sale for Novel Service System.**—The Baker Motor Vehicle Company, of Cleveland, has just reported the sale of twenty-five electric trucks, ranging in capacity from 1000 lb. to 4 tons, to the Delivery Company, of that city. The latter concern is operating a novel delivery service system. About half of its trucks are rented on a yearly basis to Cleveland concerns for their exclusive use. In connection with the continuous daily guaranteed operation of the trucks these companies have no expense other than the contract rental charge, based upon the size of the car. The other trucks are used in delivering packages, in varying quantities, for a number of Cleveland concerns, on the basis of a per package charge, depending upon the distance the package has to be carried. At the present time the Delivery Company is handling the retail delivery problems of 175 Cleveland firms, and during the month of November its cars averaged 41 miles per day and carried an average of 181 packages per car per day. On about Feb. 1, 1914, this company expects to occupy a building of its own now under construction, which will measure 100 feet by 140 ft. and will be one of the largest garages in the city. The

building, when completed, will have accommodations for seventy-five trucks, and the Delivery Company is planning to have in operation by the end of 1914 at least that number of cars of the above make. Three gasoline cars are in use for long-haul service to the suburbs.

**General Electric Company's Industrial Sales.**—Some idea of the variety and extent of the General Electric Company's business in the industrial field can be gained from the following list of companies which have recently placed with it orders for electrical equipment of various kinds: D. Auerbach & Sons, of New York City, candy manufacturers, have arranged to operate their plant with directly connected electrically driven machinery, for which 103 motors, ranging in capacity from 1 hp to 30 hp, with necessary control panels and accessories, will be employed. The American Zinc & Chemical Company, Burgettstown, Pa., will place in operation in its power plant two 2000-kw Curtis turbo-generators with 35-kw turbo-exciters, a 435-kva motor-generator set, a 300-kw generator, switchboard and auxiliary apparatus. The Firestone Tire & Rubber Company, Akron, Ohio, will add to the equipment of its plant for electric drive five large three-phase, 60-cycle, 440-volt motors, one of 400-hp, two of 500-hp and two of 700-hp rating, together with control panels. The Lehigh Portland Cement Company, Allentown, Pa., will add to the equipment of its power station a 1250-kva alternating-current generator and switchboard. The Linde Air Products Company, New York City, has ordered for installation on its plant at Kansas City, Mo., five motors ranging in size from 10 hp to 100 hp, with switchboard panels.

**Foreign Electrical Fields.**—A project is now under way for the development of a water-power site in Afghanistan and for the transmission of electrical energy at 44,000 volts to the capital city of that country, Kabul, about 40 miles from the falls. The work is in charge of A. C. Jewett, an American engineer, formerly with the General Electric Company. An outlay of between $500,000 and $600,000 will be required for the completion of this project, and approximately $300,000 will be put into machinery and materials. The electrical energy generated will be supplied to the industries of Kabul, including among others a gun factory, a woolen mill and a shoe factory. Street lighting and interior electric illumination will also be furnished to a limited extent. The machinery and material for the generating station and transmission line are being furnished by American companies, through F. & C. Osler, of Bombay, India, and Birmingham, England. With the completion of this enterprise there will probably be a demand for electrical cooking appliances in Kabul. In Edinburgh, Scotland, the municipal corporation has a monopoly of the production and distribution of electric energy for public use within the city, and the rates are comparatively low for both lighting and motor service. Electrical fittings of English, American and German make are all in use. The bayonet type of lamp and socket is most generally seen here, although the screw type is gaining in favor. Lock sockets are practically unknown and would probably find a fairly good market if offered. Metal-filament lamps are in demand, and the most common rating is 25 cp and 230 volts. The corporation does no wiring and does not handle electrical fixtures or appliances. These, with other electrical supplies and wiring devices, are obtained directly from the English and German manufacturers or from the English branches of American electrical companies.

**Private Concern Installs Sign Bearing Electrical Development Society Emblem.**—The Electrical Construction & Machinery Company, of Rock Island, Ill., is preparing to enter its new quarters at 1828 Third Avenue, Rock Island, and has planned some unusual publicity work in that connection. The building to be occupied after Jan. 1 was formerly a Y. M. C. A. branch, and the company is preparing a large roof sign, containing over 400 lamps, to call attention to the fact that the structure is no longer used for the purpose mentioned, but is now devoted to the electrical business. A 150-lamp sign over the Third Avenue entrance to the building will explain the company's field, and over the old cornerstone two attractive copper plates will be fastened, bearing the official emblem of the Society for Electrical Development, Inc. Part of the new building will be given up to the manufacture of fixtures and another section will be devoted to the exhibition of farm-lighting equipment. The Trio Manufacturing Company will occupy part of the structure in connection with its panelboard and switchboard business. In response to an inquiry as to industrial conditions in Rock Island and vicinity, the following statement was made by the first-mentioned company: "Referring to the electrical conditions generally around this part of the country, they are very satisfactory and no one has any cause for complaint. We have three cities here (Rock Island and Moline, Ill., and Davenport, Ia.), with a total population of about 150,000, all served by the Tri-City Railway & Light Company. This concern, within the last two years, has been extending its lines through the rural districts and has taken on about a dozen small towns within a radius of 30 miles from Rock Island. Its business along these lines is very satisfactory. It is also picking up quite a number of farmers as the extensions progress. Not only that, but farmers who are not on its lines are installing storage-battery plants of their own, so that the business in prospect from this one source should be very satisfactory within the next year."

**Electrical and Allied Imports in 1912-1913.**—Some idea of the extent of the electrical import business as a whole and of the relative importance of the several branches of that industry can be gained from the following table showing the values of imports of a number of materials for the year, July 1, 1912, to June 30, 1913, obtained from a tabulation recently issued by the Department of Commerce, Washington, D. C.:

VALUES OF ELECTRICAL AND ALLIED IMPORTS IN 1912-13.

| Items | Valuation | Duty |
|---|---|---|
| Aluminum: | | |
| Crude form, scrap and alloys | $4,187,580 | $1,864,947 |
| Plates, sheets, bars and rods | 347,490 | 166,803 |
| Apparatus: | | |
| Philosophical and scientific | 572,726 | ..... |
| Asbestos: | | |
| Unmanufactured | 1,760,845 | ..... |
| Woven | 94,562 | 37,821 |
| Carbons: | | |
| Electric-light, lampblack or retort carbon | 363,656 | 114,401 |
| Electrodes and brushes | 185,590 | 55,676 |
| Coal: | | |
| Bituminous and shale | 3,560,893 | 526,277 |
| Culm and slack | 807,472 | 61,230 |
| Copper: | | |
| Pigs, ingots and bars | 44,579,920 | ..... |
| China and porcelain wares, not decorated | 1,086,841 | 597,431 |
| Electric lamps: | | |
| Arc | 27,561 | 12,401 |
| Metal filament | 384,246 | 172,909 |
| Carbon filament | 78,070 | 35,130 |
| India rubber and gutta percha: | | |
| Crude | 101,377,290 | ..... |
| Manufactured | 947,235 | 331,529 |
| Hard rubber | 254,444 | 89,054 |
| Iron or steel sheets | 28,120 | 6,857 |
| Mica: | | |
| Unmanufactured | 819,902 | 280,958 |
| Ground | 6,592 | 1,317 |
| Manufactured | 107,028 | 28,048 |
| Models of inventions | 27,574 | ..... |
| Nickel: | | |
| Alloys, ingots and pigs | 123,323 | 19,782 |

**NEW YORK METAL MARKET PRICES**

| | Dec. 16 Bid. | Dec. 16 Asked. | Dec. 22 Bid. | Dec. 22 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | ..... | ..... | ..... | ..... |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 65 0 0 | | 64 3 9 | |
| Prime Lake | 14.50 to 14.75 | | 14.50 to 14.75 | |
| Electrolytic | 14.25 to 14.37½ | | 14.12½ to 14.37½ | |
| Casting | 14.00 to 14.12½ | | 13.87½ to 14.12½ | |
| Copper wire base | 15.50 to 15.75 | | 15.50 | ..... |
| Lead | 4.00 | | 4.00 | |
| Nickel | 40.00 to 45.00 | | 40.00 to 45.00 | |
| Sheet zinc, f.o.b. smelter | 7.25 | | 7.25 | |
| Spelter, spot | 5.15 to 5.25 | | 5.15 to 5.25 | |
| Tin, spot | 37.70 to 37.95 | | 36.62½ to 37.00 | |
| Aluminum: | | | | |
| Prompt delivery | 18.75 to 19.00 | | 18.50 to 19.00 | |
| Future | 18.50 to 19.00 | | 18.50 to 19.00 | |

***COPPER EXPORTS**

| | | |
|---|---|---|
| Heavy copper and wire | 13.50 | 13.50 |
| Brass, heavy | 8.75 | 8.75 |
| Brass, light | 7.75 | 7.75 |
| Lead, heavy | 3.95 | 3.95 |
| Zinc, scrap | 4.37½ | 4.37½ |

***OLD METALS**

Total tons to Dec. 22 ..... 24,999

*From daily transactions on the New York Metal Exchange.

# Corporate and Financial

**A Good Report from Milwaukee.**—The Milwaukee Electric Railway & Light Company's gross earnings for twelve months ended Oct. 31 last were about $5,970,000, in comparison with $5,620,000 in the preceding year. There was a balance of surplus over interest charges of over $1,000,000. Dividends are paid on the $14,350,000 outstanding capital stock at the rate of 6 per cent.

**Ozark Power & Water Company Supplying Large Territory.**—The large hydroelectric generating station of the Ozark Power & Water Company, on the White River in Missouri, has been in successful operation for about three months and the transmission lines, recently completed, are distributing electricity to a large area. The rating of this station is 15,000 kw and the electrical equipment was supplied by the General Electric Company. The Ambursen Hydraulic Construction Company, of Boston, Mass., built the dam and power house, and the S. Norman Smith Company furnished the hydraulic machinery. A 66,000-volt transmission line, carried in part on steel towers, connects the station with Springfield, Aurora, Monett and Joplin.

**Securities of Keokuk Electric Company.**—Stone & Webster offer for sale $250,000 worth of the 6 per cent cumulative preferred stock of the Keokuk Electric Company, an Illinois corporation. This company does the electric-railway, electric-lighting, electric-motor-service and gas business of Keokuk, Ia., receiving electrical energy from the great hydroelectric plant of the Mississippi River Power Company in Keokuk. It also does the electric-railway and electric-lighting business of Hamilton and Warsaw, Ill., and operates an interurban electric railway between Keokuk, Hamilton and Warsaw. The population served is about 20,000. It is said that the present earnings are over four and a half times the preferred stock dividend requirements.

**Stock Issue of the Ottawa Light, Heat & Power Company, Ltd.**—The directors of the Ottawa (Can.) Light, Heat & Power Company, Ltd., will offer to the stockholders of record March 1, 1914, the right to subscribe to a new stock issue, amounting to $700,000, on a basis of one new share for each four shares held. These subscriptions will be payable in five equal monthly instalments, on the first of each month, from April to August, inclusive. An extra dividend of 1 per cent, in addition to the regular quarterly 2 per cent dividend, will be paid to stockholders on Jan. 1, 1914. A similar bonus was paid on July 2 last, so the yield on the stock for the past year has been 10 per cent. The proceeds of the sale of the new stock referred to above are to be used in extensions of the company's gas and electric properties.

**Ohio Utility Merger Approved.**—The Public Utilities Commission of Ohio has approved the plans recently made for the merging of the Dayton Power & Light Company, the Wilmington Water & Light Company and the Xenia Gas & Electric Company, a proceeding which will involve the acquisition of the entire outstanding stocks and bonds of the two latter companies by the former. In connection with this consolidation permission has been granted to the Dayton company to issue 5 per cent bonds to the amount of $125,000 and 6 per cent cumulative preferred stock to the par value of $50,000 to be exchanged for the $125,000 5 per cent mortgage bonds and the $124,500 par value common stock of the Wilmington company. The Dayton Power & Light Company owns already all of the outstanding bonds and all but five shares of the stock of the Xenia company.

**Lease of Distributing Systems in Los Angeles.**—Arrangements are being perfected for the temporary lease and final acquisition by the city of Los Angeles, Cal., of the electric distributing systems within its limits now owned by the Los Angeles Gas & Electric Company, the Pacific Light & Power Company and the Southern California Edison Company. The city is planning to build a municipal hydroelectric plant in connection with its new aqueduct and will furnish electricity for use in side city limits. If the present plans are carried out, the city will lease the above-mentioned systems for five years, bearing all the expense of extension and unification during that period. At the end of that time the systems will be sold to the city. This plan, while providing the companies with an opportunity to extend their lines outside the affected territory, at the same time removes the necessity for the issue of over $5,000,000 of municipal bonds to pay for the systems as they stand, at a time when heavy expense is planned in connection with the construction of the generating station.

**Baltimore Utility Financing.**—The Consolidated Gas, Electric Light & Power Company, of Baltimore, last week applied to the Maryland Public Service Commission for permission to issue $1,416,000 in common stock. Proceeds from the sale of this stock are to be used in paying off a number of short-term notes and other existing obligations. The petition was filed by Gans & Haman and signed by Vice-president Wagner of the company. Its directors will meet early next month to ratify the application officially. The petition recites that the amended charter of the corporation provides for a total capitalization of $20,000,000. Of this amount $14,160,088 is already represented by outstanding common and preferred stock. Further, the petition says that the company has recently made extensive improvements for which bills are payable. By issuing the amount of the stock asked for at present, which will be disposed of for cash only, the company will be enabled to save large amounts of interest which it is now paying on loans and short-term notes. At the offices of the company last week it was announced that a definite date for the stock sale has not as yet been set.

**Southwestern Holding Company Financing.** — Several months ago a new holding company was formed to take over the properties of the following electric light, power and ice companies operating in the southwestern part of the United States: The Comanche Light & Power Company and the Comanche Ice Company, of Lawton, Okla.; the Mangum (Okla.) Electric Company, the Pecos Valley Gas & Electric Company of New Mexico, Artesia, N. M.; the Quanah (Tex.) Light & Ice Company, the Chillicothe (Tex.) Light & Power Company and the Duncan (Okla.) Electric & Ice Company. The new holding concern is known as the Southwestern Cities Electric Company. Operation of the properties is in charge of J. C. Keys, who has been prominently connected with similar enterprises at Scranton, Pa., and Cleveland, Ohio, and with several of the above subsidiary concerns. With a capitalization of $6,000,000, the Southwestern Cities Electric Company has $4,000,000 in common and the remainder in cumulative preferred stock, bearing interest at 6 per cent per annum to September, 1915, and 7 per cent thereafter, and participating equally with the common stock after each has received 7 per cent.

**Reorganization of the East St. Louis & Suburban Company Proposed.**—Reorganization and a change in capitalization of the East St. Louis & Suburban Company are proposed in a notice recently sent out to stockholders of that concern by E. W. Clark & Company, of Philadelphia, Pa. To escape the effects of recent legislation in New Jersey it is planned to organize under the laws of Maine a new company to be known by the same name, which will take over the assets and liabilities of the present concern. The latter controls the street-railway and electric-light properties in East St. Louis and Alton, Ill., together with interurban lines between those two points and to Belleville, O'Fallon, Collinsville and Edwardsville. Including St. Louis, the terminus of the company's line over Eads Bridge, the population served is approximately 875,000. Forty-five million passengers were carried over the company's lines in 1912, and 11,821,989 kw-hr. of electricity sold. This company has recently contracted for the sale of 5000 hp additional to large consumers in its territory, and the extensions and improvements made necessary by its increasing business require the additional funds which the reorganization will provide. The outstanding capitalization of the company is $14,000,000, divided equally between common and preferred stock. Under the new scheme, if it is approved, the same total capital will be divided into $6,000,000 common and an equal amount of 5 per cent cumulative preferred stock, with $2,000,000 of 6 per cent five-year convertible bonds. The $2,000,000 bonds, which are part of an issue of $3,000,000, will be convertible up to July 1, 1918, into an equal par value of 6 per cent cumulative preferred stock plus 33⅓ per cent of par value in common stock. The 5 per cent preferred shares may at any time be exchanged one-half into 6 per cent cumulative preferred and one-half into common stock.

## Business Notes

**The Wagner Electric Manufacturing Company,** of St. Louis, Mo., has appointed T. T. Richards assistant sales manager, instead of assistant manager, as stated in the Dec. 20 issue of the *Electrical World*.

**The Wright-Howard Electric Company,** of 439 Chamber of Commerce Building, Los Angeles, Cal., is at present engaged in the electrical contracting and repair business. Its officers are W. F. Howard, president, and G. C. Wright, secretary and treasurer.

**The Brookfield Glass Company,** of 2 Rector Street, New York, manufacturer of glass insulators, announces the opening of a Southern office at 415 Fourth National Bank Building, Atlanta, Ga. D. R. Peteet, who was formerly connected with the Southern Bell Telephone & Telegraph Company, will have charge of this office, and the company is providing every facility for rendering quick service to its customers.

**The Roland Gas Electric Vehicle Corporation,** with plant and offices at Twentieth Street and Avenue B, New York City, is making a gas-electric truck of new design. The gas engine on this company's car drives an electric generator which supplies in turn two motors, one of which is geared to each of the rear wheels. H. B. Weaver is president of the concern, and its secretary is H. H. Miller. P. K. Hexter, the designer of the car, is vice-president and general manager of the company.

**The Lumley Denly Company,** of Ashtabula, Ohio, has recently been incorporated to take over the business of the Ashtabula Manufacturing Company. The new concern will continue the manufacture of various hardware supplies and will in addition undertake the fabrication of a line of electrical specialties. The president of the new concern is Wilfred Lumley, for several years chief engineer of the Tungstolier Works of the General Electric Company. He will serve also as general manager in charge of the factory at Ashtabula. C. T. Denly, formerly with Austin & Denly, will be secretary of the new company.

## New Industrial Companies

**The Ellis Electric Company,** of Rockford, Ill., has been incorporated by T. C. and G. Ellis and A. D. Linton. The company is capitalized at $15,000 and proposes to do a general electrical contracting business.

**The Miners' Safety Electrical Lamp Company,** of Newark, N. J., has been incorporated by E. O. Bannick, F. E. Seiler and E. Barnes, of Newark. The company is capitalized at $125,000 and proposes to manufacture miners' safety electric lamps.

**The Lucas Electric Device Company,** of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and sell electrical and mechanical machinery, devices, etc. The incorporators are Mellen C. Martin, Herbert Bobb and Earl O. Taylor.

**The Button Bell Manufacturing Company,** of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture electrical appliances. The incorporators are John McGullan, Robert Logan and Thomas Cassidy, 641 Fifty-third Street, Brooklyn, N. Y.

**The Federal Heating Company,** of Buffalo, N. Y., has been granted a charter with a capital stock of $15,000 to do a general contracting and electrical engineering business The incorporators are George C. Fox, Jeremiah A. Sullivan and Julius A. Schreiber, all of Buffalo.

**The United Gas & Electric Engineering Corporation,** of New York, N. Y., has been incorporated with a capital stock of $100,000 to do a consulting and contracting engineering business. The incorporators are H. Morgan, G. H. Olney and W. M. Clark, of New York, N. Y.

**The Newburgh Supply Company,** of New York, N. Y., has been incorporated by W. M. Hackland, of New York, N. Y.; B. W. Dole, of Newark, N. J., and J. W. Lane, of East Orange, N. J. The company is capitalized at $25,000 and proposes to do a general contracting business, deal in sand, cement, concrete, electrical construction, etc.

## Trade Publications

**Electric Signs.**—The Valentine Electric Sign Company, Atlantic City, N. J., has issued a card, size 7 in. x 9 in., referring to its electric signs. It contains a picture of the first "Do it electrically" sign that was installed by the Valentine Company for the Toledo Railways & Light Company.

**Bushings.**—A leaflet issued by the New Process Specialty Company, Enterprise Building, Milwaukee, Wis., refers to its Universal bushings. Two types are shown, one for use in switch boxes, loom boxes and all ⅝-in. knockouts and another for holding flexible tubing in cabinets, junction boxes and in all ½-in. conduit knockouts. A price list is given.

**Direct-Current Generators.**—Special Bulletin 22.5 of the Western Electric Company, New York, has for its subject direct-current generators. The bulletin gives a fully illustrated description of a very complete line of this class of apparatus, among the machines mentioned being engine-driven generators, three-wire engine-driven generators, marine generating sets, belt-driven direct-current generators and other types.

**Motors.**—Bulletin No. 247 of the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, refers to its round-type direct-current motors. These motors are manufactured in nine sizes of frames, ranging from 0.25 hp to 7.5 hp in output. Their general construction is fully described. A table showing the ratings of these motors and another giving the dimensions are included.

**Globes.**—The H. Northwood Company, Wheeling, W. Va., has issued an attractive catalog illustrating and briefly describing its "Luna" illuminating glassware. The soft-toned paper offers an excellent medium for showing to advantage illustrations of its various types and designs in globes. Charts are given of tests made by the Electrical Testing Laboratories, New York, showing the vertical distribution of light of a number of types of reflectors.

**House-Lighting Plants.**—The Edison Storage Battery Company, Orange, N. J., has issued an instruction book for installing and operating the Edison storage-battery house-lighting plant. It contains twenty-four pages, and the instructions are given in a lucid manner readily understood by the non-technical man. The illustrations and the carefully prepared wiring diagrams cannot fail to be of assistance to the owner of the individual lighting plant equipped with Edison batteries.

**Gifts Electrical.**—The Electric Shop of Chicago issued recently an interesting twenty-four-page booklet illustrated with pen-and-ink sketches telling of the convenience and usefulness of electrical appliances as Christmas gifts. As inquiries by mail were not solicited from the prospective customers to whom this particular pamphlet was sent, the quoting of specific prices was avoided. The object of the booklet was to impress upon its recipients the facilities of the Electric Shop and to bring them to the store for their Christmas selections.

**Storage Batteries.**—A pamphlet of twenty-four pages devoted to the general subject of Edison storage batteries in industrial transportation has recently been issued by the Edison Storage Battery Company, Orange, N. J. Industrial trucks, industrial railway locomotives, baggage trucks, freight trucks, tractors, cranes, engines and mining locomotives, equipped with Edison batteries, are briefly described and illustrated. The booklet is interesting as showing the extent to which the storage-battery equipment of trucks has succeeded other methods of haulage.

**Railway Line Material.**—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a number of pamphlets covering railway line material. Catalog Section DS840 covers suspensions, ears and splicers. Section DS841 covers frogs, crossings, section insulators, switches and lightning arresters which are fully described and illustrated. Section DS844 covers strain insulators of various types and for different kinds of service. Section DS850 covers rail bonds and bonding tools and gives in some detail the methods of the manufacture and the selection of rail bonds.

# Personal Mention

**Mr. A. A. Hinton,** formerly connected with the Kaufman (Tex.) Light & Power Company, has become manager of the De Queen (Ark.) Ice & Light Company.

**Mr. Charles E. Bush,** of Tulsa, Ariz., has taken a position as general manager of the Tulare County Power Company, Tulare, Cal., vice Mr. C. E. Taylor, resigned.

**Mr. R. A. Wood,** of Warren, Ohio, has been appointed new-business manager of the Brush Electric Company of Galveston, Tex., as successor to Mr. A. K. Young.

**Mr. A. H. Rich** has been appointed general manager of the local office of the Coast Valleys Gas & Electric Company at Salinas, Cal., vice Mr. M. H. Gregg, resigned.

**Mr. A. K. Young,** who for the past two years has been in charge of the new-business department of the Brush Electric Company of Galveston, Tex., has joined the New York staff of Henry L. Doherty & Company.

**Mr. Aldis E. Hibner** has resigned as commercial manager of the Empire Gas & Electric Company, Auburn, N. Y., and has become associated with the Cumberland County Power & Light Company, Portland, Me., as sales manager.

**Mr. J. R. Evans,** who for the past four years has been manager of the Yorktown (Tex.) Light & Ice Company, has been retained in his present position by Mr. E. A. Clousnitzer, who purchased the system and who will make extensive improvements to the generating and transmission equipment after the first of the year.

**Mr. M. S. Sloan,** who has been assistant to Mr. A. H. Ford, president of the Birmingham (Ala.) Railway, Light & Power Company, has been made assistant to Mr. J. S. Pevier, vice-president of the New Orleans (La.) Railway & Light Company and chairman of the executive committee of the American Cities Company.

**Dr. Walter A. Rigg** has tendered his resignation as general manager of the Reading (Pa.) Transit & Light Company, effective Jan. 1. Although retiring from active management, Dr. Rigg will retain his interest and holdings in the underlying companies which were leased to the Reading (Pa.) Transit & Light Company.

**Mr. Milo R. Maltbie,** public service commissioner of the First District, New York, has been chosen as head of the sub-committee of the National Association of Railway Commissioners which will work with the Interstate Commerce Commission in the valuation of railroad properties throughout the country. This appointment will involve a vast amount of detail work without remuneration and will occupy whatever of Mr. Maltbie's time is not now required by his work as public service commissioner.

**Mr. Edward Schildhauer,** electrical and mechanical engineer for the Isthmian Canal Commission, who has had supervision of the design and construction of the entire electrical generating, distributing and lock-control systems for the Panama Canal, is a graduate of the electrical engineering school of the University of Wisconsin at Madison. Following graduation Mr. Schildhauer joined the engineering staff of the then Chicago Edison Company and continued in its service for several years. When the canal work was started he was summoned to Panama and undertook the design of the elaborate electrical equipment required for the operation of this great work. Since being stationed in the Canal Zone, with headquarters at Culebra, Mr. Schildhauer has made several visits to the United States, during one of which the degree of electrical engineer was accorded to him by his alma mater at Madison. Since 1901 Mr. Schildhauer has been a member of the American Institute of Electrical Engineers, and early in the present year he was made a Fellow. He is a member of the American Society of Mechanical Engineers.

EDWARD SCHILDHAUER

**Mr. M. H. Gregg** has resigned as general manager of the local office of the Coast Valleys Gas & Electric Company, Salinas, Cal., and accepted a position as secretary of the joint-pole committee which includes representatives of all of the large electric corporations now doing business in Oakland, Cal.

**Mr. John Bellamy Taylor,** after fourteen years' connection with the General Electric Company, has resigned as engineer of the foreign department in order to take up work independently as a consulting electrical engineer. Mr. Taylor, who was born in Brookline, Mass., in 1875, was graduated from the Massachusetts Institute of Technology in 1897. Following his graduation he became connected with the New England Telephone & Telegraph Company, and afterward was manager of the Burlington (Vt.) exchange and assistant to the division superintendent at Lowell, Mass. His connection with the General Electric Company began in 1899, when he joined the staff of the district engineer of the Boston office. There he remained until 1902, when he was transferred to the railway engineering department at Schenectady. In that department, and until appointed one of the company's consulting engineers in 1910, Mr. Taylor had to do with the details and problems of power house and substation design, transformer and rotary converter operation, parallel operation of alternating-current machinery, systems of connections for transmission and distribution and like work. At the time the single-phase railway system began to attract public attention Mr. Taylor's previous telephone experience led him to foresee many of the difficulties to be encountered in the telegraph and telephone problems presented, and he devoted himself actively to tests in the laboratory and in the field on points bearing on the signal and power relations. He presented a paper to the American Institute of Electrical Engineers in 1909 on "Telephone and Telegraph Systems as Affected by Alternating-Current Lines," and his services were sought by the Western Union Telegraph Company as an expert adviser in connection with the electrification of the New York, New Haven & Hartford. Bearing on the above problem, and perhaps related more closely to physics than to electrical engineering, may be mentioned Mr. Taylor's long-continued interest in acoustical matters. Before graduating, parts of his summer vacations were spent in church-organ factories, and, incidentally to his other work, he has advised on and supervised organ work. He was one of the first to demonstrate the possibilities of the oscillograph in studying telephone and telegraph problems and for sound analysis. With other engineers of the General Electric Company, he applied the oscillograph to a study of some of the electrical and acoustical problems of the "telharmonium." In the optical branch of physics Mr. Taylor was the first to demonstrate the much-discussed phenomenon of more than normal candle-power for a very brief interval from a tungsten lamp when first switched into circuit, to which he assigned the now familiar term of "overshooting." Soon after the placing on the market of the "autochrome" plate, he took up color photography and has done much work in this line with stereoscope, spectroscope and microscope, recently presenting papers to the American Physical Society showing some results of his investigations. In 1905 Mr. Taylor was awarded a prize of 1000 francs by the Association des Industriels de France contre les Accidents du Travail for his indicator showing the state of charge of an electrical conductor. He has taken an active interest in the work of the American Institute of Electrical Engineers and other scientific and engineering societies. The past year he was chairman of the Schenectady Section of the A. I. E. E. He is an honorary member of the Association of Railway Telegraph Superintendents. Mr. Taylor will continue to live in Schenectady, where he has his laboratory, and expects to divide his time between that place and New York City.

JOHN B. TAYLOR

# Construction

## New England

BOSTON, MASS.—Bids will be received by the Commissioner of Public Works of the city of Boston, 49 City Hall, Boston, until Jan. 15, 1914, for furnishing and erecting an electrically operated pumping plant for high-pressure fire service in the proposed underground pumping station in Charles Street, between Beacon and Boylston Streets. Forms of proposals and a set of two plans showing general arrangements and details may be obtained at Room 49, City Hall. L. K. Rourke is commissioner of public works.

NORWICH, CONN.—Within the next two months the Board of Lighting Commissioners expect to erect a concrete pumping station, 13 ft. by 15 ft. by 18 ft., at the municipal electric plant to provide space for pumping machinery to pump water for turbo units. S. J. Kehoe is manager.

WALLINGFORD, CONN.—The Board of Electric Light Commissioners expects to purchase within the next two months an additional two-phase panel for switchboard, 150-kw transformer (to convert energy from two-phase to three-phase) for the municipal electric-light plant, and to erect about 1 mile of transmission line; also within the next ten months to erect an addition to plant to provide space for office, storage and workrooms, etc., to cost about $7,000. A. L. Pierce is manager of the municipal electric-light plant.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by Henry S. Thompson, commissioner Department of Water, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, until Dec. 30 for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places from Jan. 1, 1914, to Dec. 31, 1914, both inclusive. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

BROOKLYN, N. Y.—Bids will be received by Henry S. Thompson, commissioner Department of Water Supply, Gas and Electricity, Room 1904, Park Row Building, New York, until Dec. 30 for furnishing, installing, maintaining and reserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 1830 kw of three-phase, 6600-volt, 25-cycle electrical power and furnishing and delivering this power, under the terms of this contract, from Jan. 1, 1914, to Dec. 31, 1914, both inclusive, at each of the high-pressure fire-service pumping stations in Brooklyn, at Furman and Joralemon Streets and at Willoughby and St. Edward's Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

COHOES, N. Y.—The State Conservation Commission has approved the application of the Cohoes Co. for the construction of a dam forming the forebay connecting the Cohoes Co.'s canal in Cohoes with the hydro-electric plant now under construction in the Mohawk River.

DUNKIRK, N. Y.—Steps have been taken by the Board of Water Commissioners to issue $15,000 in bonds to purchase two 400-hp boilers and a new condenser for the municipal water and electric-light plant and for payment of current bills.

EAST ROCHESTER, N. Y.—The Dispatch Ht., Lt. & Pwr. Co., of East Rochester, has applied to the Town Board of Perinton for permission to furnish electricity in that town.

FULTON, N. Y.—The Board of Public Works has awarded the contract for wiring and lighting the Broadway Bridge to the Fulton Lt., Ht. & Pwr. Co. for a period of 10 years at $26.15 per lamp standard. The plans provide for 30 standards.

GENESEO, N. Y.—The Geneseo Gas Lt. Co. has recently placed contracts for new engine, generator and street lamps. O. W. Landon is superintendent.

JAMAICA, N. Y.—Bids will be received by Maurice E. Connolly, president of the borough of Queens, Borough Hall, Fifth and Jackson Streets, Long Island City, N. Y., until Dec. 30 for furnishing labor and material for electric equipment for the town hall in Jamaica. Bids and blank forms may be obtained and plans and drawings seen at the above office.

JAMESTOWN, N. Y.—The Board of Park Commissioners has received a report from the General El. Co. outlining plans and recommendations for the proposed ornamental street-lighting system. The plans were submitted as follows: (A) For the installation of 105 6.6-amp luminous arc lamps to be suspended by brackets from trolley poles; the cost is estimated at $7,505 and maintenance at $5,022 per year; (B) for 89 6.6-amp luminous arc lamps, to be erected on ornamental standards, maintained by underground wires, to cost $13,727 and maintenance $4,256 per year; (C) provides for the erection of 213 ornamental lamp standards, to be equipped with either a single 500-watt lamp or five smaller units of 100 watts each, to cost $15,471 and maintenance $11,789 per year. The board has taken the matter under consideration.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 5, 1914, for furnishing all labor and material required for the erection and completion of the general contract and electric work for the additions and alterations to storehouse at Blackwell's Island. Blank forms and further information may be obtained at the office of Frank J. Helmle, architect, 190 Montague Street, Brooklyn, where plans and specifications may be seen. Michael J. Drummond is commissioner.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 5, 1914, for furnishing all labor and material required for electric wiring, gas piping and fixture work for the training school for nurses, maternity ward, reception building and boiler house, City Hospital, Blackwell's Island. Blank forms and information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissoner of Department of Water, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, until Dec. 30, for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places from Jan. 1, 1914, to Dec. 31, 1914, as follows: No. 1, for borough of Manhattan; No. 2, borough of the Bronx; No. 3, borough of Manhattan and the Bronx; No. 4, borough of Queens; No. 5, borough of Richmond. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 29 for installing electric-lighting equipment in the grand stands and on the athletic fields, Avenues K and L and East Seventeenth Street, borough of Brooklyn; Orchard Avenue and Munson Street, Astoria, borough of Queens; Hamilton Avenue and St. Mark's Place, New Brighton, borough of Richmond. A separate proposal must be submitted for each item. Blank forms, plans and specifications may be obtained or seen at the above office, also at the branch office, 69 Broadway, Flushing.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissioner of Department of Water, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, until Dec. 30 for furnishing and installing, maintaining and reserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle electrical power, under the terms of this contract, from Jan. 1, 1914, to Dec. 31, 1914, both inclusive, at each of the high-pressure fire-service pumping stations in the borough of Manhattan at Oliver and South Streets and at Gansevoort and West Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

ONTARIO, N. Y.—The New State Rys. Co. has awarded contract for construction of new building to replace its substation in Ontario destroyed by fire in November; also for equipment, including one 500-kw, 25-cycle rotary with necessary transformers to step down from 11,000 volts, switchboard apparatus, etc., and one 500-kva frequency changer, 25 to 60 cycles, for furnishing electricity to the Sodus Gas & El. Lt. Co. for distribution to its customers within a radius of approximately 10 miles. C. L. Cadle is electrical engineer.

SHERMAN, N. Y.—The Sherman El. Lt. Co. is erecting a storage battery to use on peak load. C. E. Cobb is president and manager.

BARNESBORO, PA.—Notice has been filed by John Barnes, Ernest L. Clark and Harry E. Bird that application will be made to the Governor for a charter for the Barnesboro-Spangler El. Lt. Co. It is expected that the Barnesboro and Spangler companies will be consolidated.

CAMBRIDGE SPRINGS, PA.—The Cambridge Springs El. Lt. Co. expects to purchase within the next 12 months 50 meters. C. W. Young is general manager.

CLEARFIELD, PA.—Papers have been filed announcing the consolidation of the Bellefonte El. Co., the Moshannon El. Co. and the Tussey Gas Co. with the Poe Steam Co., of Clearfield. The new company will be known as the State Centre El. Co. and will be capitalized at $575,000. The incorporators are: A. W. Lee, president; J. W. Wrigley, A. J. Musser and P. T. Davis, of Clearfield, Pa., and John S. Fisher, of Indiana, Pa.

LEBANON, PA.—The American Iron & Steel Co., of Lebanon, has closed a contract with Siemens & Halske, of Berlin, Germany, through their New York office, for two 20-ton induction furnaces of the Frick type. The furnaces will be of the double-ring type and will run on five cycle, single-phase and about 5000 volts. The power requirements will be about 1800 kw each. Two new generators will probably be installed by the company to operate the furnaces. The method of drive for the generators has not yet been decided upon.

MOUNT CARMEL, PA.—The Edison El. Ltg. Co., of Mount Carmel, expects to increase the generating capacity of its plant within the next ten months and will install generators with either engine or turbine. I. W. Keiser is superintendent.

PITTSBURGH, PA.—The Southside El. Co., of Pittsburgh, has surrendered its franchises and privileges to the local authorities. The company will sell its power plant and equipment to the Duquesne Lt. Co., of Pittsburgh.

READING, PA.—The County Commissioners have awarded the contract for lighting the new Penn Street Bridge to the Metropolitan El. Co., of Reading, for a period of five years. The company has sub-

mitted 11 proposals, ranging in cost from $1,580 to $3,076 per year, to the commissioners. As yet the commissioners have not made a selection.

HADDONFIELD, N. J.—Estimates have been submitted to the new Borough Commission of the cost of installing and operating a municipal electric-light plant, the power to be supplied from the water-works plant.

HARRISON, N. J.—The Board of Trade is negotiating with the Town Council for the approval of a plan to install a flaming-arc-lamp lighting system on Harrison Avenue, from Davis Avenue to the Bridge Street Bridge.

TRENTON, N. J.—The Board of Public Utility Commissioners has approved an ordinance granting permission to the Western Union Tel. Co. to place its wires underground in the streets of Trenton.

NEWARK, DEL.—Within the next six months the Water and Light Commissioners expect to purchase some wire, meters and tungsten lamps. S. B. Hindman is secretary.

BALTIMORE, MD.—The Public Service Commission has authorized the Consol. Gas, El. Lt. & Pwr. Co., Baltimore, to issue $743,000 in bonds for improvements and extensions to its electric and gas distribution system and enlarging plant. Of the proceeds $606,000 will be used for the electric system and $137,000 for the gas department.

LOGAN, W. VA.—The Ohio Valley Co., recently incorporated, it is reported, contemplates the construction of an electric power plant, the equipment to consist (ultimately) of six 5000-kw turbo-generator units, operated by a battery of boilers with automatic stokers. Present plans provide for an initial installation of one 5000-kw unit, the others to be installed as demands require. From 27 to 60 miles of transmission lines will be erected. The cost of the power plant and distributing system is estimated at $750,000. J. M. Ashley is president and Godfrey M. S. Tait is manager, 1413 G Street, N. W., Washington, D. C., and 90 West Street, New York, N. Y.

BOYCE, VA.—Bids will be received by the Town Council until Jan. 5 for a franchise to install and operate an electric-light system. J. F. Stinson is acting mayor.

FREDERICKSBURG, VA.—Within the next 12 months the El. Generating Co., of Fredericksburg, expects to do some concrete work, install gates, etc., at its dam, 2 miles from town; also to purchase material for distribution system, including poles, wire, meters, transformers, etc.; also wiring supplies as needed. W. Key Howard is superintendent.

RICHMOND, VA.—Superintendent E. W. Trafford in his report submitted to the administrative board asks for $125,452 for the municipal electric-light plant for the coming year. He estimates the cost of operation at $46,066, and the remainder is for extensions, which include the installation of three new feeders, extending from the electric plant to the east, west and central parts of the city, and transformers to install three additional arc-lamp circuits; $3,700 is asked for the purchase of 100 additional arc lamps.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Jan. 5, 1914, for furnishing to the Signal Corps under proposal 686 the following supplies: 75 large-interval time bells, 35 small-interval time bells, 400 5-amp fuses, 500 1-amp fuses, 150 10-amp fuses, 40 Stromberg-Carlson loud-ringing extension bells, etc. For further information address Major W. L. Clarke, disbursing officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 6, 1914, for supplies to be delivered at the various navy yards and naval stations as follows: Newport, R. I., Schedule 6144—5000 lb. of phosphide of calcium. Key West, Fla., Schedule 6140—16 miscellaneous watt-hour meters. Washington, D. C., Schedule 6142—miscellaneous drawn-brass tubing, 780 lb. 4-in. I.D. Tobin bronze tubing, 53½ ft. 14-in. steel tubing. Bids will also be received until Jan. 13, 1914, as follows: Portsmouth, N. H., Schedule 6157—two motor-driven pressure blowers. Philadelphia, Pa., Schedule 6150—one 60-hp vertical tubular boiler and erecting the same. Bids will also be received until Jan. 20, 1914, Brooklyn, N. Y., Schedule 6132—six 5-kw radio sets for ship installation. T. J. Cowie is paymaster-general, U. S. N.

## North Central

CRYSTAL FALLS, MICH.—Within the next eight months the Light and Water Department expects to purchase a 300-kw generator and waterwheel. J. H. Saunders is superintendent.

DETROIT, MICH.—Plans, it is reported, are being prepared for an addition to the power plant of the Convent of the Sacred Heart, Grosse Pointe.

DETROIT, MICH.—The Detroit Edison Co. on Dec. 19 took out a permit for the construction of a reinforced-concrete power station, to cost $400,000, to be built on Lycasre Street near River Street. This is to be a part of the new East Side plant of the company, designed to duplicate the Delray plant. Work on construction will begin at once.

DETROIT, MICH.—The stockholders of the Detroit Edison Co. have approved the proposal authorizing an issue of $6,000,000 in bonds and to increase the capital stock from $15,000,000 to $25,000,000. It is proposed to issue $3,500,000 of the bonds at par to the stockholders, the proceeds to be used for reimbursing the treasury for expenditures for improvements, etc., already made and to provide funds for extensions, etc., contemplated for the immediate future.

GREENVILLE, MICH.—Within the next eight months the R. J. Tower El. Co., of Greenville, expects to build a new concrete dam and penstock and reset turbines; also to purchase waterwheels. The company is purchasing constantly electrical appliances, including heating and cooking apparatus, washing machines, wiring supplies, etc. S. L. Tower is manager.

HIGHLAND PARK, MICH.—All bids submitted Nov. 3 for the installation of an ornamental street-lighting system in Highland Park were rejected. The village may take up the question in 1914. R. M. Ford is clerk.

JACKSON, MICH.—Application has been made to the Michigan State Railroad Commission by John Carton, attorney, of Flint, representing the Commonwealth Pwr. Co., for permission to issue $349,000 in bonds for improvements to the systems of the following companies: The Saginaw Pwr. Co., $10,000; Consumers' Pwr. Co., $69,000; Pontiac Pwr. Co., $3,000; Bay City Pwr. Co., $6,000; Flint El. Co., $4,000; Grand Rapids & Muskegon Pwr. Co., $29,000; Au Sable El. Co., $87,000; Economy Pwr. Co., $133,000.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co., it is reported, will erect a new transmission line to Northern cities, including Richmond, New Haven, Lenox and other towns. The cost of the line is estimated at $9,000.

OXFORD, MICH.—The Eastern Michigan Edison Co., of Detroit, has been granted a franchise to operate in this township.

SAULT STE. MARIE, MICH.—The Edison Sault El. Co., of Sault Ste. Marie, is constructing an addition to its power plant. Orders have already been placed for equipment. William Chandler is vice-president and general manager.

STURGIS, MICH.—The Board of Public Works expects to purchase within the next six months 30 ornamental lamp standards (for clusters or for single lamp, probably single series tungsten or nitrogen lamps); also within the next 12 months to purchase 150 meters, line material and transformers, costing approximately $4,000, and to purchase heating and cooking apparatus, vacuum cleaners and washing machines as demands require.

VICKSBURG, MICH.—At a special election held Dec. 15 the proposal to sell the municipal electric-light plant was defeated. The lighting plant will require extensive repairs, and funds to provide for same will necessitate the calling of a special election in the near future.

ALLIANCE, OHIO.—The Alliance Gas & Pwr. Co. has recently completed the construction of a new central station having an output of 2500 kw. The equipment consists of six boilers with a rating of 375 hp each, a coal-handling device arranged with an elevator carrying coal to the hopper bins in side cars, and a 1250-kw General Electric steam turbine. W. J. Rose is general manager.

CANTON, OHIO.—The Knight Tire & Rubber Co., of Canton, is installing additional equipment in its power plant, including a 650-hp generating unit, consisting of a Crocker-Wheeler generator, a Cooper-Corliss engine, a Cutler-Hammer switchboard, and three General Electric transformers (two 15-kva and one 20-kva). Melbourne Brothers, of Canton, are contractors.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. will furnish the street-lighting service during the year 1914 at the same rate given this year.

CLEVELAND, OHIO.—Work, it is understood, will be commenced by the city on the installation of a lighting system in the down-town district early next year. Cables will be laid under the street and 500 standards will be erected in the business district.

CLEVELAND, OHIO.—Plans are being considered by Mayor Baker, Director of Public Service Springborn and City Electrician Sarbinsky to compel the public utilities companies to eliminate all overhead wiring along the streets on which street cars are operated. It is estimated that approximately 125 miles of wires would have to be placed underground.

CLEVELAND, OHIO.—The City Council has authorized an expenditure of $60,000 for general piping and motor-driven pumping apparatus and accessories for the new municipal lighting plant. The sum of $45,000 has been set aside for the purchase and installation of transformers, foundations, wiring, instruments, switchboards, etc. J. W. Springborn is director of public service.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, No. 204 City Hall, Cleveland, until Jan. 7, 1914, for economizers, fans, etc., for the municipal electric-light plant in accordance with plans and specifications, which may be obtained in the office of the engineer of construction, Room 419, City Hall. Bids must be submitted on blanks furnished by the engineer of construction. W. J. Springborn is director of public service and W. H. Kirby, secretary.

EATON, OHIO.—Within the next two months the Eaton Ltg. Co. expects to purchase one 72-in. by 18-ft. horizontal tubular boiler. F. J. Jackle is superintendent.

FREMONT, OHIO.—Application has been made by the Ohio Lt. & Pwr. Co., which controls plants in Fremont, Fostoria, Newark, Mount Vernon, Lancaster, Logan, Lexington and other towns in the State, to the Ohio Public Utilities Commission for permission to issue $1,300,000 in bonds and $720,000 in capital stock, the proceeds to be used for extensions and improvements to its properties.

GREENWICH, OHIO.—The Board of Public Affairs has recently installed in the municipal electric-light plant one 100-kva, alternating-

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current generator and exciter, also one switchboard panel for same, one 16-kva street-lighting regulator and switchboard panel. The company has replaced 27 arc lamps with 100 series tungsten lamps of 125 cp. T. H. Daniels is clerk.

LEIPSIC, OHIO.—The Leipsic El. Lt. Co. has recently purchased material for one-half mile of three-phase pole transmission line and three 15-kw transformers. J. W. Cottingham is proprietor.

LIMA, OHIO.—The contract for the electric light and power plant for the county infirmary, including the wiring of the buildings, has been awarded to the Sackett Mine Supply Co., Columbus, Ohio, at $1,785.

NELSONVILLE, OHIO.—The city of Nelsonville expects to purchase within the next 12 months material for distribution system, including transformers, poles, insulators, wire and meters and about $600 worth of incandescent lamps. C. C. Sharp is director of public service.

OBERLIN, OHIO.—The Oberlin Gas & El. Co. has just purchased a motor-generator, exciter and material for distribution system. Paul M. Loewe is general manager.

PORT CLINTON, OHIO.—The City Council has engaged the United Engineering Construction Co., Schofield Building, Cleveland, to prepare plans for the construction of the new municipal electric-light plant, for which bonds to the amount of $30,000 were authorized.

RAVENNA, OHIO.—Bids will be received at the office of the director of service until Dec. 29 for furnishing the necessary machinery, material and labor for the construction of a pumping plant at Muzzy Lake and Crystal Lake stations, in accordance with plans and specifications on file in the office of the director of public service. Work at Muzzy Lake station includes a new fireproof (brick and concrete) building, two motor-driven centrifugal pumps of 2000 gal. per minute capacity, one motor-driven centrifugal sump pump, intake and discharge pipes and 6000 linear ft. of transmission line, consisting of two three-phase lines complete. At the Crystal Lake station: one turbo-generator unit with a normal rating of 150 kw or 300 kw with exciter and condenser; one switchboard and one pump of 2000 gal. per minute normal capacity. Bids for this pump will be received on a crank and flywheel steam pump Corliss gear, a steam-turbine-driven centrifugal pump or a motor-driven centrifugal pump. John S. Mallette is director of service.

SHERWOOD, OHIO.—During the past year the gas engine in the municipal power plant has been replaced with a steam plant, at a cost of about $2,000. The equipment of the plant includes a 55-hp horizontal tubular boiler, one 35-hp automatic engine (boiler and engine manufactured by Houston, Stanwood & Gamble Co.), directly connected to a 40-kw, 125-volt Westinghouse generator. G. W. Woodworth is manager.

SHILOH, OHIO.—We are informed that the village of Shiloh does not contemplate the installation of a municipal electric-light plant as reported in the issue of Nov. 15. Electricity for operating the local system is obtained from the plant in Plymouth. H. S. Maring is village clerk.

SWANTON, OHIO.—The Swanton Lt. & Pwr. Co. is erecting a substation at Swanton, the equipment to include one five-panel General Electric switchboard and three 75-kva transformers. Ten miles of No. 4, 6, and 8 wire and 35-ft. (7-in.-top) poles will be used. All material has been purchased. Electricity for operating the system will be obtained from the plant of the Auglaize Pwr. Co., of Defiance. T. J. Pilliod is secretary.

WILMINGTON, OHIO.—The Dayton Pwr. & Lt. Co. has applied to the Public Utilities Commission for permission to take over by Jan. 1 the properties of the Xenia Gas & El. Co., of Xenia, and the Wilmington Wtr. & Lt. Co., of Wilmington. The Dayton company will operate both holdings separately, but will maintain transmission lines connecting all three systems. A line is nearly completed between Dayton and Xenia and from Xenia to Wilmington; a line will also be erected to supplement the electrical generating capacity of each plant. Electricity will also be furnished to farmers residing along the transmission lines.

WOOSTER, OHIO.—The installation of an ornamental street-lighting system in the business section is under consideration by the Board of City Commissioners.

ASHLAND, KY.—The name of the Ashland El. Lt. Co. has been changed to the Boyd County El. Lt. Co. and the limit of its indebtedness placed at $200,000.

BARBOURVILLE, KY.—The installation of a municipal electric-light plant in Barbourville is reported to be under consideration.

HORSE CAVE, KY.—J. T. Morton and P. T. Vaughn, of Horse Cave, are installing an electric-light plant in connection with their business to furnish electricity for lamps and motors here. The equipment will include one 50-hp Voght boiler, one 30-hp Gardiner engine and a 250-kw direct-current Clarke generator with switchboard for same and 150 poles. About 75 meters have been spoken for; lamps and meters have not yet been purchased.

IRVINE, KY.—Plans are being considered by V. M. Gaines, of Irvine, for the installation of an electric-light plant here. A franchise, it is understood, will be sold within 30 days.

MURRAY, KY.—The City Council has entered into a contract with the City Lt. Co., of Murray, for lighting the streets of the city for a period of 20 years. Under the terms of the contract new lamps and fixtures are to be installed throughout the city. Wires in the business section will be placed underground and ornamental standards carrying four-lamp (60-watt-tungsten) clusters will be erected.

BATESVILLE, IND.—The Batesville El. Lt. & Pwr. Co. is completing a new power plant having an output of 750 kw. A. W. Romweber is purchasing agent.

COLUMBIA CITY, IND.—Within the next year the managers of the municipal electric-light plant will erect a coal conveyor to carry coal from the railroad track to the boiler room. F. T. Schultz is superintendent.

KNIGHTSTOWN, IND.—The town of Knightstown has recently purchased a 100-kw Curtis steam turbine and a new air compressor. N. Hiatt is superintendent.

ASTORIA, ILL.—The Central Illinois Public Ser. Co., of Mattoon, has purchased the property of the Astoria El. Lt., Ht. & Pwr. Co.

BLANDISVILLE, ILL.—Within the next six months C. R. Huston, owner of the local electric-light plant, expects to purchase some 4-ft. by 18-in. flues.

CAIRO, ILL.—The Cairo Ry. and Lt. System is erecting a 16,000-volt transmission line from Cairo to Mounds City and to Mounds. All material has been purchased.

CLAYTON, ILL.—During the next year the Central Illinois Pub. Ser. Co., of Mattoon, Ill., expects to change the local power house to a substation. As yet no plans have been decided upon. Edward B. Doocy is local manager.

EARLVILLE, ILL.—The City Council has granted the Illinois Northern Utilities Co., of 137 South La Salle Street, Chicago, a franchise to furnish electricity in Earlville and also a contract for street lighting. The company exepects to erect a new distribution system and install tungsten lamps on gooseneck posts for street lighting, except in the business district, where the city is contemplating installing an ornamental street-lighting system. Mr. Danielson, of Mendota, is engineer in charge. O. E. Fischer is city clerk.

GALESBURG ILL.—The capital stock of the Galesburg Ry., Ltg. & Pwr. Co. has been increased from $50,000 to $3,500,000. W. H. Carnahan is president.

JACKSONVILLE, ILL.—The City Council has adopted a resolution providing that if the $50,000 bond issue for the construction of an electric-light plant is approved at the election to be held Dec. 20 it will favor the construction of the series tungsten street-lighting system as outlined in Proposal B, details of which were published in the issue of Nov. 22.

MASCOUTAH, ILL.—The managers of the municipal electric-light plant expect to purchase some poles within the next six months. Charles Sparn is superintendent.

MORRISONVILLE, ILL.—The Southern Illinois Lt. & Pwr. Co., of Morrisonville, is erecting 4 miles of 16,000-volt transmission line to Palmer and substation with distribution lines and street lamps. The company is also installing a 200-kva Terry turbine with generating equipment, three-phase, 16,000-volt transformers and lamps, arresters and 2300-volt switchboard with General Electric regulator, and 3,000 ft. of steam-heating mains to supply 15,000 ft. radiation (American District Steam Co. has contract). The company is also installing Westinghouse street-lighting regulator and equipment for 150 series tungsten lamps. Paul Dewitt is manager.

OQUAWKA, ILL.—The managers of the municipal electric-light plant have recently purchased a 60-kw direct-current generator. Charles L. Brooks is manager.

BLACK RIVER FALLS, WIS.—The municipal electric-light plant, which was entirely destroyed by flood on Oct. 19, 1913, has been rebuilt. H. H. Parsons is city clerk.

CLINTONVILLE, WIS.—Within the next 12 months the town of Clintonville expects to purchase one 12-in. by 24-in. Corliss engine, one 150-kw, 60-cycle, three-phase, 2300-volt generator, three-pole, double-throw switches for 2300 volts, one Tirrill regulator, two switchboards and integrating wattmeters for the municipal electric-light plant. George C. Stewart is superintendent.

EAU CLAIRE, WIS.—Within the next six months the Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, expects to erect 30 miles of 30,000-volt transmission lines. George B. Wheeler is secretary and general manager.

KILBOURNE, WIS.—The Electric Light Commission expects to purchase within the next six months one 100-kva or 125-kva frequency-changer set; also within the next three months one small motor-driven centrifugal pump of about 75 gal. per minute capacity, heating and cooking apparatus, coffee mills, vacuum cleaners, washing machines and other labor-saving devices. David G. Howey is manager.

LANCASTER, WIS.—The Lancaster El. Lt. Co. has been reorganized and the name changed to the Lancaster Lt. & Pwr. Co.; the capital stock has been increased to $100,000. Arrangements are being made to erect a transmission line from Lancaster to Fennimore, for which material has been purchased. The erection of a transmission line to at least one other town is contemplated. The company, it is understood, is also planning to increase the output of the plant and will install new equipment, including engine, boilers, etc. The new officers are: H. L. Clarke, of Chicago, president; George P. Angus, vice-president and manager; Benjamin Squire, secretary and treasurer.

MARSHFIELD, WIS.—The Water and Light Commission expects to put into operation the new cross-compound Corliss engine directly connected to a 375-kva, 2300-volt generator, purchased from the Allis-Chalmers Co., within the next 30 days. T. N. Young is superintendent.

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PARDEEVILLE, WIS.—Within the next 12 months the local electric light company expects to purchase one waterwheel and pump; also electrical appliances and supplies, including washing machines, wiring supplies, switches, etc. Joseph Chandler is treasurer and manager.

BLOOMING PRAIRIE, MINN.—Within the next eight months the L. G. Campbell Mfg. Co., of Blooming Prairie, expects to purchase a 75-kva, 2300-volt generator. George Upcraft is superintendent.

FLOODWOOD, MINN.—Investigations are being made by the Floodwood Commercial Club to find the cost of establishing and operating a municipal electric-light plant here. M. W. Hingeley is president.

OAK PARK, MINN.—The installation of an electric-light plant in Oak Park is reported to be under consideration. Leon C. Wiley is interested.

PERHAM, MINN.—A committee, consisting of Amos Marckel, Dr. Berthold and others, has been appointed by the City Council to make investigation relative to improving and enlarging the municipal electric-light plant or to purchase electricity to operate the municipal electric-light system.

WARREN, MINN.—The City Council expects to erect within the next eight months an addition to power-house and to purchase one boiler, one 150-kw, 2250-volt generator, one 250-hp engine, feed-water heater, smokestack, condenser and a switchboard panel with recording instruments, etc. The Council will engage a consulting engineer at once to take charge of the proposed work. W. R. Haney is superintendent.

CEDAR RAPIDS, IA.—The Iowa Ry. & Lt. Co., of Cedar Rapids, has applied for a franchise to erect a high-tension transmission line from Cedar Rapids to Tama and Toledo, a distance of 52 miles, which, it is understood, will ultimately provide for a high-tension transmission line, extending from Anamosa to Perry, 184 miles long.

DES MOINES, IA.—The City Council, we are informed, does not contemplate the installation of a municipal electric-light plant as reported in the issue of Nov. 29. Horace Susong is city clerk.

DUBUQUE, IA.—The Union El. Co. is now installing a 5000-kw turbine purchased last spring. All auxiliaries were purchased at the same time.

EARLVILLE, IA.—At a special election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

ELMA, IA.—Within the next eight months the managers of the municipal electric-light plant expect to purchase one 60-in. by 16-ft. high-pressure boiler with all necessary fittings. Frank Gue, Jr., is superintendent.

OSKALOOSA, IA.—The Oskaloosa Trac. & Lt. Co. expects to purchase within the next 12 months a 750-kw alternator and engine and a 350-hp boiler; also to erect additional transmission lines. H. W. Garner is general manager.

PILOT MOUND, IA.—The contract for the construction of the proposed municipal electric-light plant has been awarded to Martin & Smedes El. Co., of Des Moines. W. H. Groves, of Ames, Ia., is engineer in charge; L. C. Calson is city clerk.

SAC CITY, IA.—The Sac City El. Co. expects to erect within the next six months 17 miles of 13,200-volt, three-phase transmission line and to purchase one 250-hp Corliss engine. H. W. Deininger is general manager.

FULTON, MO.—Bids will be received by the board of managers of the Missouri School for the Deaf at Fulton until Jan. 13, 1914, for furnishing two new horizontal tubular boilers, complete, moving present boilers, engines, pumps, etc.; resetting same, rearranging main and heating pipes, filling, grading and concreting floors in new power house, as outlined in special specifications, and all to be included in one proposition. Plans and specifications are on file at the institution and also at the office of M. F. Bell, architect, Fulton. D. A. Sharp is president of board.

JOPLIN, MO.—The Empire District El. Co., of Joplin, has applied to the State Public Utilities Commission of Kansas for permission to issue $150,000 to $200,000 in bonds to extend its transmission lines and enlarge power plants at Joplin and Lowell, Kan. The company is now installing a low-pressure steam-driven turbine at Lowell.

MARSHALL, MO.—The City Council has called a special election to be held Dec. 18 to submit the proposal to issue $70,000 in bonds for the construction of a municipal electric-light plant to the voters. The proposition was recently defeated.

PERRYVILLE, MO.—The power house and distribution system of the Perry County Public Utilities Co. were completed in July. A deep well which will serve the electric plant and from which the city may be supplied is nearly finished. A. D. Brinkerhoff is secretary and treasurer of the National Lt. & Pwr. Co., of St. Louis, which controls the Perry County company.

ST. CHARLES, MO.—The American Lt. & Pwr. Co., of St. Charles, has applied to the Missouri Public Service Commission for permission to erect transmission lines in St. Charles County outside of the incorporated boundaries of St. Charles, in order to furnish electrical service to farmers and unincorporated villages in this county.

WEST PLAINS, MO.—The Board of Public Works expects to purchase within the next 12 months about 25 meters. W. P. Britain is superintendent.

BLAIR, NEB.—At an election held Nov. 28 the proposal to issue $35,000 in bonds for the construction of a municipal electric-light plant was defeated. An item was published in the issue of Oct. 25 stating that the proposal to issue bonds for a municipal electric-light plant and for extensions to water-works system had been carried.

PRAGUE, NEB.—Within the next 10 months the village of Prague expects to erect a new building for the municipal electric-light system. Anton Kasper is village clerk.

SEWARD, NEB.—The city of Seward expects to purchase within the next six months one 150-hp high-pressure boiler, one 125-hp, three-phase generator and switchboard, and one 42-in. by 125-ft. smokestack; also within the next three months it expects to purchase one carload of 25-ft. and 30-ft. (7-in. top) poles. J. Martz is superintendent.

STRATTON, NEB.—The Board of Trustees is contemplating the purchase of a 15-hp, 220-volt direct-current motor within the next six months. Elmer Martin is engineer.

HANOVER, KAN.—Within the next nine months the managers of the municipal electric-light plant expect to purchase a boiler and engine, or oil engines, switchboard panels, poles, insulators, wires, meters, incandescent lamps, posts, transformers, heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc.; also to erect extensions to transmission line. J. G. Granzer is superintendent.

OTTAWA, KAN.—The Board of Water and Light Commissioners may possibly purchase within the next 10 months a water-tube boiler, and possibly a steam turbine within the next 18 months. W. O. Myers.

## Southern States

FAIRMONT, N. C.—The town of Fairmont is contemplating the installation of a municipal electric-light plant, to cost about $10,000.

LILLINGTON, N. C.—Plans are being considered by W. T. Brown, of Lillington, and associates to build an electric-light plant to furnish electricity in Lillington. The proposed plant will have an output of about 50 kw. Boiler, engine, generator, switchboard, wire, poles, etc., are to be purchased. Mr. Brown would like to receive estimates of cost of the proposed equipment.

ROXBORO, N. C.—The Roxboro Lt. & Pwr. Co. has recently installed a horizontal, double-acting plunger pump (Dean Brothers) and a stationary heater. M. R. Long is secretary and manager.

SPRAY, N. C.—The Marshall Field Co., of Spray, it is reported, contemplates the installation of a steam power plant, to cost $150,000, to operate its cotton mills.

TARBORO, N. C.—Improvements are being made to the municipal electric-light plant, involving an expenditure of about $10,000. New engines and generator will be installed. J. H. Jococks is city clerk and treasurer.

WILMINGTON, N. C.—The City Council is contemplating engaging an engineer to make a survey and prepare estimate of cost of the installation of a municipal electric-light plant.

TIMMONSVILLE, S. C.—The Carolina Lumber & Pwr. Co., of Timmonsville, has recently installed a 150-hp high-pressure boiler. A. L. Broom is secretary and treasurer.

WALTERBORO, S. C.—A proposal for the installation of an electric-light plant in Walterboro has been submitted to the City Council by the Walterboro Ice. & Lt. Co. and Mr. Ingraham, of Savannah, Ga.

GLENNVILLE, GA.—Bonds for the construction of a municipal electric-light plant have recently been voted. Dr. L. A. De Loach is Mayor.

MADISON, GA.—Within the next six months the electric-light commission expects to rebuild one-half mile of transmission line and to purchase within the next eight months one motor-driven pump, one car load of 35-ft. poles, and a car load of 45-ft., 50-ft. and 60-ft. poles. G. W. Hubbard is superintendent.

BARTOW, FLA.—The City Council has adopted an ordinance authorizing an expenditure of $20,000 for extensions and improvements to the municipal electric-light plant and $6,000 to extend the lighting system and to establish an ornamental street-lighting system.

DAVENPORT, FLA.—Within the next two months the Davenport Lt. & Ice Co. expects to erect an 85-line telephone system. The company also expects to purchase within the next 30 days all kinds of household appliances, such as a central station would use to build up a load factor. It will also need some small singe-phase, 110/220-volt motors, from 1/12 hp to 3 hp. H. T. Natziger is secretary.

JACKSONVILLE, FLA.—New equipment is now being installed in the municipal electric-light plant, including two 520-hp Babcock & Wilcox boilers, eight switchboard panels and 14 50 magnetite-arc-lamp tub transformers; also three 1000-kva, 6600/2300-volt transformers in substation and six three-phase, 2300-volt regulators. W. H. Tucker is superintendent.

LABELLE, FLA.—An extension has recently been completed to the E. E. Goodno electric-light and ice plant and a 150-hp boiler installed.

LEESBURG, FLA.—The Leesburg Ice Co. is extending its transmission line to the next town, a distance of 5 miles. Material for the extension has been contracted for. J. Y. Clark is president.

OCALA, FLA.—The Florida Pwr. Co., of Ocala, has recently closed a contract with the Dunnellon Phosphate Co. to furnish six of its plants with hydroelectric power and also five overburden outfits. The company will also install motors in its machine and railway shops. In order

to supply this service the Florida Pwr. Co. will erect a substation at Hernando, the equipment to consist of three 500-kva water-cooled, single-phase transformers, stepping down from 60,000 volts to 11,000 volts. The distribution lines will carry 11,000 volts and at each one of the plants the energy will be stepped down from 11,000 to 2200 volts. Orders have recently been placed with the Westinghouse El. & Mfg. Co., of Pittsburgh, Pa., for high-tension breaker, lightning arresters, 11,000-volt breakers and other necessary auxiliary apparatus, B. C. Camp is president of the Florida Company.

TAMPA, FLA.—The Tampa El. Co. has called a meeting of the stockholders to be held Jan. 5, 1914, to vote on the proposal to increase the capital stock of the company by $374,000, the proceeds to be used to pay for improvements and extensions during the present year and for further improvements during the coming year.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co., it is reported, contemplates extensions and improvements to its system, for which estimates are now being prepared. Ford, Bacon & Davis, of New York, N. Y., are chief engineers.

CARBON HILL, ALA.—Within the next two or three months the managers of the municipal electric-light plant expect to purchase deep-well pumping equipment; also within the next two months one 35-hp motor to drive a gin and possibly a 15-hp motor for another industrial plant. L. C. Smith is superintendent.

EUFAULA, ALA.—Within the next two months the Electric Light and Gas Department of the city of Eufaula expects to install a condenser connected to engine, purchased from the Wheeler Condenser & Engine Co. J. L. Skinner is superintendent.

OZARK, ALA.—Within the next 12 months the city of Ozark Water and Light Department expects to purchase three 100-hp boilers, one 200-kw generator and switchboard, one 300-hp Corliss engine, one water heater, one boiler-feed pump, one 10-in. deep well, one air compressor, one large pump, etc. B. C. Dowling is superintendent.

BELZONA, MISS.—The Electric Light Commissioners expect to purchase within the next 12 months some electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. J. J. Sislof is superintendent.

CLARKSDALE, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 27 for construction complete, including mechanical equipment and approaches, of the United States post office and court house at Clarksdale, Miss. Drawings and specifications may be obtained from the above office or from the custodian of site at Clarksdale. O. Wenderoth is supervising architect.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co. has recently completed an extention to its power-house and is now installing a 2,000-kw turbine and erecting a smokestack (180 ft. by 8 ft. 6 in.).

TYLERTOWN, MISS.—The Tylertown Lt. & Pwr. Co. expects to purchase within the next 12 months a 60-hp engine. C. A. Stevens is secretary and treasurer.

YAZOO CITY, MISS.—The Public Service Commission has purchased for January delivery a motor-generator and a six-panel switchboard. James S. Butler is superintendent.

BRINKLEY, ARK.—The Brinkley Wtr. & Lt. Co. expects to change its system from direct to alternating current and to lay about 12,000 ft. of 4-in. water mains. The company has not yet decided when this will be done. J. W. Neff is superintendent.

DE QUEEN, ARK.—The De Queen Ice & Lt. Co. expects to purchase within the next six months a 25-kva, or 35-kva, single-phase, 60-cycle revolving-field generator, and exciter, switchboard, instruments, etc. A. A. Hinton is manager.

FORT SMITH, ARK.—A movement has been started for the establishment of a municipally-owned electric plant.

LITTLE ROCK, ARK.—Within the next six months the Merchants' Ltg. Co., of Little Rock, expects to install a 1200-hp boiler and necessary piping, also one 2500-kva turbine and generator, one 50-kw motor-generator exciter set and switching apparatus for same. C. E. Rose is secretary and manager.

MENA, ARK.—Within the next few months the Mena El. Lt. & Pwr. Co. expects to purchase a series tungsten street-lamp regulator and 150 hoods for street lamps.

BOYCE, LA.—The town of Boyce expects to award contracts on Jan. 12 for one 60-hp or 65-hp oil engine and one 50-kva, 60-cycle, 2300-volt generator complete. W. L. Thompson is superintendent.

HUGO, OKLA.—Improvements are contemplated to the plant of the Hugo Ice & Lt. Co., recently taken over by the American Pub. Ser. Co. Material, including weatherproof wire, transformers, poles and insulators, will probably be purchased within the next 30 to 60 days. Additional equipment for the plant has not yet been decided upon. H. E. Mole, engineer, 55 Liberty Street, New York, N. Y., is purchasing agent. J. W. Dawley is vice-president and general manager.

MEDFORD, OKLA.—The new brick power-house for the municipal electric-light plant has been completed, replacing the one destroyed by fire on Aug. 12. Charles Berger is superintendent.

GILMER, TEX.—The Texas Pub. Ser. Co. has recently completed the erection of a power house and ice-storage plant. Theodore Dienst is business manager.

HOUSTON, TEX.—The Houston Ltg. & Pwr. Co. has recently built an addition to its boiler room and an extension to the engine and turbine room is now under way. The company has placed orders for one 6,250-kva generator and turbine; also pump and condenser. W. W. Reed is superintendent.

KERRVILLE, TEX.—The Kerrville El. Lt., Ht. & Pwr. Co. has recently installed a small engine and a 13½-kw, 2,300-volt, three-phase, 60-cycle alternator (belted). T. Holdsworth is proprietor and manager.

## Pacific States

CENTRALIA, WASH.—The Commissioners of Lewis County have granted the Washington Pub. Ser. Co. a franchise to erect a pole transmission line on the old Chehalis Road between this city and Chehalis, and along Harrison Avenue in Centralia, northwest to the county line. The company proposes to transmit electricity from its plant at White Salmon on the Columbia River.

SPOKANE, WASH.—The capital stock of the Washington Wtr. Pwr. Co., of Spokane, has been increased from $15,000,000 to $20,000,000. The larger portion of proceeds will be used in the construction of a power plant at Long Lake and the remainder in connecting up several small towns in the Cœur d'Alene mining district with transmission lines.

WILBUR, WASH.—The Wilbur Electrical Co. has sold its plant and holdings to the Washington Wtr. Pwr. Co., of Spokane, which will take over the property Jan. 1, 1914. The Washington Wtr. Pwr. Co. will furnish electrical service here from its plant on the Spokane River.

CARLTON, ORE.—The Yamhill El. Co., of Newberg, is extending its 11,000-volt transmission line from Lafayette to Carlton to furnish electrical service here. An outside substation will be erected to meet the requirements for about 100 kw. About 200 poles and No. 4 B. & S. copper wire will be required for the distributing system and about 100 meters. The work is being done by the company and is well under way. C. J. Edwards is manager.

PORTLAND, ORE.—The commissioner of public utilities has recently instructed the Portland Ry., Lt. & Pwr. Co. to install arc lamps in the Laurelhurst district to take the place of the cluster lamps now in use.

ST. JOHNS, ORE.—Property owners have recently petitioned the City Council for the installation of arc lamps on certain streets in the city.

COACHELLA, CAL.—The Coachella Valley Ice & El. Co. has applied to the Public Service Commission for authority to issue $300,000 in bonds, the proceeds to be used for extensions to its system. The company proposes to erect a transmission line from the high-tension transmission line of the Southern Sierras Pwr. Co. in Banning through Coachella, where a substation is to be erected, at a cost of about $11,000. The transmission line, which will be carried into the Imperial Valley, will cost $211,887. The company also expects to erect a 55,000-volt transmission line from Banning to El Centro, connecting with the high tension line from San Bernardino at Banning. The Coachella company proposes to furnish electricty to the Holton Pwr. Co., of Holton, to be distributed in the Imperial Valley. W. F. Holt, of Redlands, represented the Coachella company.

GRIDLEY, CAL.—The city of Gridley expects to purchase within the next 12 months 100 meters, 50 kva in transformers, some No. 600 wire and 50 street-lamp globes. E. R. Fagan is superintendent.

TUCSON, ARIZ.—A hydroelectric power company, headed by Ralph Cameron, Col. Epes Randolph and Eugene S. Ives, has been tentatively organized in Tucson for the purpose of constructing a large power dam across the Colorado River in the Grand Canyon near Bright Angel trail. Electricity generated at the plant would be transmitted to towns, mining camps and irrigation districts in every part of the State. The reservoir would also furnish water to irrigate large tracts of land. Mr. Cameron holds water rights at the proposed site at the foot of Bright Angel trail.

ELY, NEV.—The Ely Lt. & Pwr. Co. may install an additional engine in its plant soon. L. B. Hedge is chief electrician.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 10, 1914, for furnishing switchboard, electric cable, conduit and fittings and miscellaneous electrical apparatus, oil-burning galvanizing pots and motor-driven dry-kiln and dry-room equipment. Blanks and general information relating to this circular (No. 815) may be obtained at the above office. For details see proposal columns. Major F. C. Boggs is general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 13, 1914, for furnishing cold-rolled steel, wire cable, chain, sheet brass, sheet copper, brass tubing, etc. Blanks and general information pertaining to this circular (No. 814) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

## New Incorporations

HOMEDALE, IDAHO.—The Homedale Wtr., Lt. & Pwr. Co. has been chartered with a capital stock of $150,000 to establish a plant in Homedale. The incorporators are C. M. Hill, D. F. Sullivan, Otto Zimmerman and S. H. Clawson.

LA SALLE, ILL.—The La Salle-Peru Gas & El. Co., of La Salle, has been incorporated with a capital stock of $700,000 by H. J. Vane, J. A. Knowlton and R. F. Carley, of La Salle. The company proposes to operate gas and electric plants.

WINSTON-SALEM, N. C.—The North Carolina Ser. Co. has been incorporated with a capital stock of $50,000 to construct and operate an electric-light plant.

LA MOURE, N. D.—The La Moure Lt. & Pwr. Co. has been incorporated with a capital stock of $24,000 by M. A. Erickson, T. A. Curtiss and others.

HARRISBURG, PA.—Seventeen charters were granted recently by the State Department, ten of which will operate in Schuylkill and adjoining counties. Each company is capitalized at $5,000 and the names are as follows: West Mahanoy, Schulykill, East Mahanoy, Conyngham, Shenandoah, Mahanoy City, Frackville, Centralia, Ashland and Gilberton El. Cos. Charters were taken out by Alfred Marshall, S. Fuhrman Marshall and Alfred M. Wildman, of Langhorne, for the Bristol, Hulmeville, Langhorne Manor, Middletown, Bensalem and South Langhorn Electric Cos. Each company is capitalized at $5,000. A charter was also granted to the Bradford El. Lt. & Pwr. Co., of Bradford, with a capital stock of $150,000.

HARRISBURG, PA.—Charters for 14 electric companies to operate in eastern Pennsylvania counties have been granted by the State Department. Seven of the companies are to operate in Bucks County, with an office in Allentown, and seven in Susquehanna County, with offices in Scranton. Charters for Bucks County were taken out by H. R. Fehr, A. S. Cantlin and Charles N. Wagner, of Allentown, and are as follows: Springfield Township, Richland Township, Hilltown, East Rock Hill Township, Doylestown, Hatfield and New Britain El. Lt. & Pwr. Cos. H. S. Kirk, W. J. Lewis and W. J. Arnold, of Scranton, were granted charters for the companies in Susquehanna County as follows: Lanesboro, Oakland Township, Great Bend, Great Bend Township, Bridgewater Township, New Milford and Susquehanna County Lt. & Pwr. Cos. The latter is to operate in Oakland Borough. Each company is capitalized at $5,000.

CHINCOTEAGUE, VA.—The Delmarva Lt., Ht. & Refrig. Corpn., has been incorporated with a capital stock of $50,000. The company recently purchased an ice and light plant and will develop from 180 hp to 250 hp. The officers are: Henry Conant, of Chincoteague, president; Joseph T. Rowley, treasurer, and Charles F. Warner, manager.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 16, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

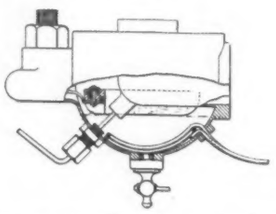
1,081,292. LOCOMOTIVE TRUCK; A. F. Batchelder, Schenectady, N. Y. App. filed Jan. 3, 1913. The parts of the electric locomotive on which the platform is supported on the truck frame are spring-supported and pivoted on an axis disposed longitudinally of the truck.

1,081,300. METHOD OF TESTING ELECTRICAL CONDUCTORS; H. M. Friendly, Portland, Ore. App. filed May 31, 1911. For measuring resistance, insulation and locating faults.

1,081,308. VAPOR ELECTRIC APPARATUS; A. McL. Jackson, Schenectady, N. Y. App. filed Jan. 9, 1904. Mercury-vapor rectifier for alternating current.

1,081,309. VAPOR ELECTRIC APPARATUS; A. M. Jackson, Schenectady, N. Y. App. filed Oct. 31, 1904. Thin-metal seal for the tube and a conductor provided with a conductive disk held in contact with the cap.

1,081,342. ELECTRIC TRACTION SYSTEM; L. B. Stillwell, Lockwood, N. J., and F. N. Waterman, Summit, N. J. App. filed Jan. 11, 1905. Source of polyphase current from which the motors take energy when driving load and to which the motors return energy when driven by the load and a rheostat automatically cut in to absorb returned energy in excess of that required.



1,081,729.—Heating Coil for Carburetors

1,081,365. THERMOPILE; W. W. Coblentz, Washington, D. C. App. filed Oct. 28, 1913 (dedicated to the public). Receivers attached to certain of the junctures of the thermal elements with some of the receivers overlapping.

1,081,368. SELECTOR MECHANISM; E. B. Craft and A. F. Dixon, New York, N. Y. App. filed Jan. 11, 1908. For use in automatic and semi-automatic telephone exchange systems.

1,081,413. ELECTRICAL SYSTEM; R. Varley, Englewood, N. J. App. filed June 16, 1913. Ignition system embodying two coils in inductive relation with means for short-circuiting one coil.

1,081,414. ELECTRIC HEATING ELEMENT; A. A. Warner, New Britain, Conn. App. filed May 6, 1913. Resistance wire formed into a coil and the coiled wire wound about a mandrel.

1,081,433. AUTOMOBILE SIGNALING APPARATUS; J. L. Cayer, Chicago, Ill. App. filed Oct. 16, 1912. A front signaling device operates a rear signaling device.

1,081,463. APPARATUS FOR GENERATING STEAM; J. B. Pentz, New York, N. Y. App. filed March 15, 1913. Water is supplied, drop by drop, to a vaporizing chamber, whence vapor flows to a superheating chamber.

1,081,490. DEVICE FOR MUFFLING SOUNDS; A. Dare, Philadelphia, Pa. App. filed March 15, 1912. For rendering it impossible for a second person to hear message spoken into telephone.

1,081,493. ANTISEPTIC CONTAINER; E. M. Doeringer and A. C. St. Marie, San Francisco, Cal. App. filed Nov. 23, 1912. Hollow conoidal antiseptic containing body having lugs engaging in the perforated partition of a telephone mouthpiece.

1,081,498. ELECTRIC LIGHT FIXTURE; L. Gudeman, New York, N. Y. App. filed Jan. 27, 1913. Portable lamp stand in which the strain of clamping the parts together is taken up by a central pipe.

1,081,531. METHOD OF MAKING STORAGE-BATTERY ELECTRODES; H. C. Hubbell, Newark, N. J. App. filed April 11, 1910. Forms thread-like material from powdered metallic nickel or cobalt, mixes with hydroxide of same, dries and then deposits metallic nickel or cobalt on exposed surfaces.

1,081,550. ELECTROPNEUMATIC BRAKING SYSTEM; W. C. Myers, Oakland, Cal. App. filed May 22, 1913. Combination of pneumatic and dynamic braking.

1,081,572. ELECTRICAL SIGNALING SYSTEM; H. Bewlay, Newark, N. J. App. filed July 2, 1912. Alternating current is superimposed upon direct current for the operation of selective signaling apparatus.

1,081,581. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; J. S. Crossley, Solvay, N. Y. App. filed Dec. 31, 1910. Waterproof socket provided with a plurality of integral ribs in the interior of the porcelain body.

1,081,635. ELECTRICAL MEANS FOR PRODUCING SOUND; O. Stritter, Berlin, Germany. App. filed Nov. 9, 1911. Electric horn in which the tone is regulated by an adjustable spring.

1,081,641. ALTERNATING-CURRENT RECTIFIER; E. J. Wiggins, Chicago, Ill. App. filed May 12, 1913. Rotary type; has means for accelerating the movable member to a given speed.

1,081,656. ATTACHMENT PLUG; A. M. Bradley, Napoleon, Ohio. App. filed March 13, 1913. Plug is attached by simply pushing it into a socket, it having yielding threaded parts which spring into engagement with socket.

1,081,671. HIGH-TENSION DISCONNECTING SWITCH; A. S. Kalenborn and A. J. Pahl, San Francisco, Cal. App. filed Dec. 30, 1911. The contact members rotate toward and away from each other on the axis of the wire.

1,081,681. ALTERNATING-CURRENT-MOTOR CONTROL; D. Larson, Yonkers, N. Y. App. filed Aug. 31, 1910. For elevators; includes inductive apparatus for automatically regulating current to the motor and means for retarding action of said apparatus.

1,081,696. MAGNETO-ELECTRIC GENERATOR; E. P. and F. I. Remy, Anderson, Ind. App. filed Feb. 17, 1910. Armature mounted in non-revolvable position relative to the rotary inductors.

1,081,712. KEY CONSTRUCTION AND RELEASE FOR TELEPHONIC APPARATUS; W. P. Andrick, E. Lowe and H. W. Haff, Jamaica, N. Y. App. filed Sept. 2, 1911. Keys complete circuits; automatically stay as long as communication is desired and automatically return when communication is terminated.

1,081,729. HEATING COIL FOR CARBURETORS; W. A. Erkenbrack, Webster, S. D. App. filed July 11, 1913. Heating coil disposed in bottom of float chamber beneath the float.

1,081,749. ELECTRIC DISTRIBUTION SYSTEM; L. B. Jones, Kansas City, Mo. App. filed March 15, 1913. Whenever demand for current is created the prime mover for the generator is brought into motion and continues to run so long as the demand for current exists.

1,081,760. IGNITION DYNAMO; C. T. Mason, Sumter, S. C. App. filed April 23, 1912. Stationary magnet and a rotor so positioned that the magnetic flux is established through winding, the rotor at all times maintaining the same polarity.

1,081,789. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Aug. 11, 1911. Pull switch in which movement is obtained by spirally slotted sleeve.

1,081,827. STARTING DEVICE FOR ELECTRIC MOTORS OR THE LIKE; W. Griebe, Brooklyn, N. Y. App. filed Feb. 12, 1913. Embodies blocks or slides carrying different resistances which may be interchangeably inserted in the starting box.

1,081,843. INDICATOR; L. S. Larson, Toledo, Ohio. App. filed March 11, 1913. Device which automatically indicates to the engineer the amount of water in the ballast tanks.

1,081,884. BURGLAR ALARM; E. C. and F. W. Bertagnolli, Central City, Col. App. filed Aug. 22, 1912. Includes flexible circuit wires stretched across the window or other opening.

1,081,912. SMELTING FURNACE; K. O. E. Olausson, Trollhättan, Sweden. App. filed Sept. 6, 1911. Electric furnace in which a condensing chamber is arranged outside the furnace chamber, wherein the condensible gases are separated from the non-condensible gases.

1,081,925. RAILWAY SIGNALING SYSTEM; A. V. T. Day, New York, N. Y. App. filed July 24, 1906. For controlling traffic on the electric-traction systems.

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Alphabetical and Classified Indices, Fourth Page Preceding Back Cover

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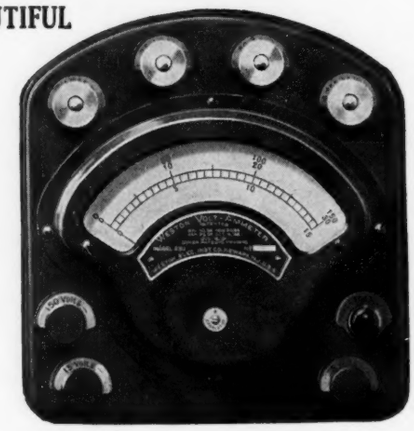

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# ELECTRICAL WORLD

DECEMBER 27, 1913

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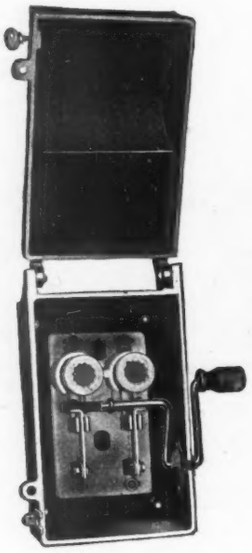
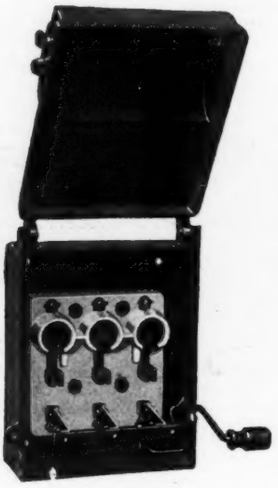


Cat. No. 4211 E
Showing two-pole Switch for Edison Plug Fuses
This Switch is equipped with Porcelain Base



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The McKeever Electric Co., 99 N. 3rd Street, Columbus, O.
The Maydwell Co., 409 Sheldon Bldg., San Francisco, Cal.
Mr. A. H. Kling, 1195 Woodward Avenue, Detroit, Mich.
The Perkins Electric Co., Ltd., 322 Craig Street, W., Montreal, Can.

# The L & N Dial Decade Portable Testing Set Type S

## A New Design With Radical Improvements
## Small—Accurate—Inexpensive

**Here is the story in brief:—**

Size—7⅜"x8¾"x4½".
Weight—8 pounds.
Switches—Dial Type. No plugs used. Contacts are all underneath the rubber plate and thus protected from dust and dirt, but are readily accessible for inspection.
Accuracy—1/10% in Rheostat, 1/20% in Ratio.
Galvanometer—Our new interchangeable type. Sensitivity 1 megohm.
Directions—Complete directions for making resistance measurements and the loop tests for locating faults in lines and cables accompany each instrument.
Guarantee—Fully protects the purchaser against defects in material or workmanship.

**Price, $60**

Bulletin No. 530 goes more into detail. Let us send you a copy.

## The Leeds & Northrup Company

**Electrical Measuring Instruments**

4903 Stenton Avenue, Philadelphia

# CUTLER-HAMMER

## Nearly a Million in Use

THERE is a steady and growing demand for this leader of pendent switches. Wherever you go you will find the C-H No. 7000 porcelain pendent. Nearly a million are in use today.

It has that ingeniously simple C-H quick make-and-break mechanism. It is most easily operated by the single horizontal push-bar.

It comes in three tints, gray, white and brown, to match any surroundings. It has a good appearance and can always be made to look like new after years of service by wiping with a moist cloth.

**N. E. C. Standard**
**6 Amp.**
**125 Volts**
**3 Amp.**
**250**
**Volts**

## Most Convenient to Operate.

THIS switch was the first to have the simple horizontally—operated push-bar which is recognized as providing the most covenient means of operation.

Taking hold of the switch the thumb is naturally placed in the position to operate the push-bar.

Only one hand is needed and there is no tendency to push the switch up out of the hand as with pendents operated from below.

The simple, quick make-and-break C-H mechanism used is the only one specially adapted for operation by the single push-bar.

Check up your stock of these switches now and see if you don't need more. Bulletin 8650 sent on request.

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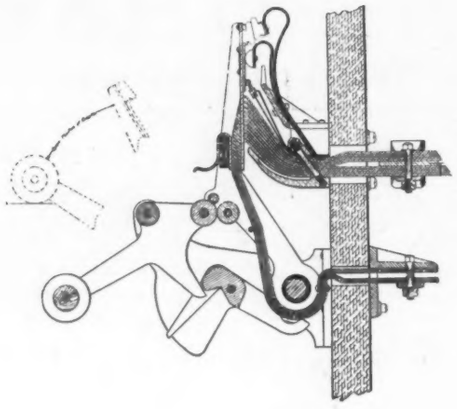
# Roller-Smith Circuit Breakers



The illustration shows the method of stud construction on circuit breakers of over 1200 amperes capacity. There is no joint between the face of the laminated brush and points of contact between stud and bus-bar. This is one of the details which serves to put the *Roller-Smith* circuit breaker in a class by itself.

When the armature rises on an overload it does not merely release a trigger which allows something else to work—it directly and persistently *forces* the breaker open. And it does open—in a hurry. That is what you want and must have if a circuit breaker is to perform its intended functions.

"Readiness to serve" is characteristic of Roller-Smith circuit breakers and the policy of the Roller-Smith Company.

## Roller-Smith Company

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Offices:

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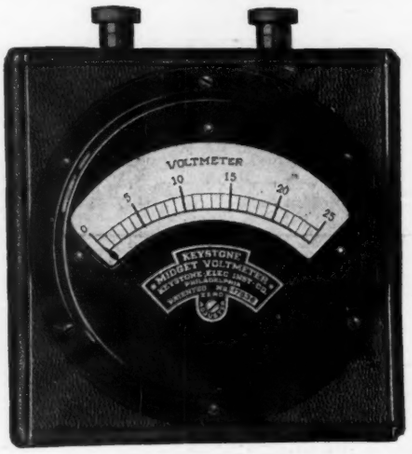
# Keystone Midget Ammeters and Voltmeters




A new line of 3" instruments in switchboard and portable types, of perfect design and workmanship supplied at a moderate price. Send for new bulletin.

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## SPLITDORF

SPLITDORF "TS" COILS, MAGNETOS and SPARK PLUGS form a trinity of ignition perfection that every owner of a gasoline motor should know about.
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ELECTRICAL CONTROLLING APPARATUS
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**THE MONITOR SYSTEM OF AUTOMATIC CONTROL**
For Electric Motor Drive
**"Just Press a Button"**
START—STOP—REVERSE—ACCELERATE—DECELERATE
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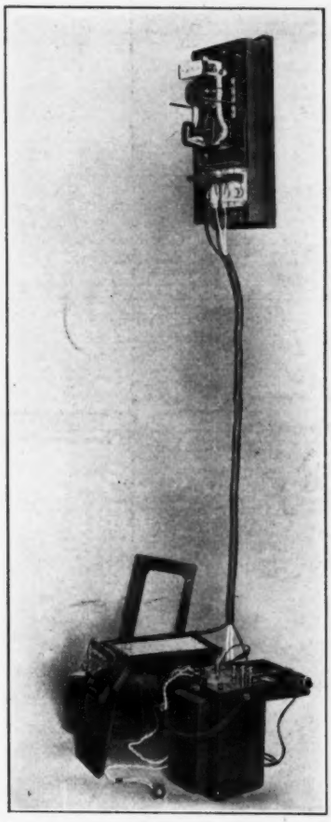

## Cut the Cost of Meter Testing

You can by-pass the consumer's installation, maintain the same polarity, place the meter fields in series if required, or make any other connections required in preparing the meter for test, without interrupting service, if you use

# Metropolitan
## Meter Protection

You also secure the highest possible economy of installation and put all meter connections under a tamper-proof seal.

Our descriptive bulletins go fully into the details of this important matter and will be sent at your request.

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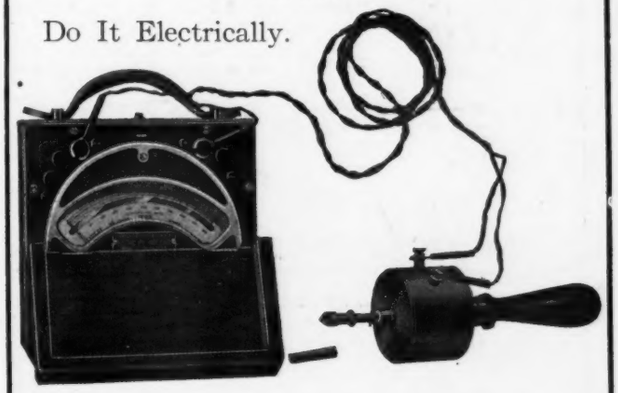
No Flexible Shaft.

Do It Electrically.



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Suitable for all classes of commercial and laboratory service. Write now for bulletin descriptive of both portable and stationary models.

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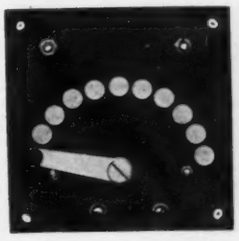
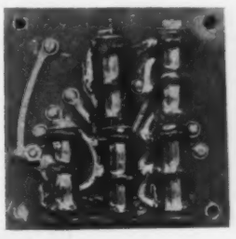
## Ward Leonard Resistance Units

Are the most satisfactory resistance elements for use in your rheostat, because—Smallest possible size—Lightest weight—One layer of wire—Any resistance up to 5,000 ohms on a single unit—Resistance wire protected by glass enamel—Will not absorb moisture—Zero temperature coefficient—Non-inductive—Will last for years.

Front View



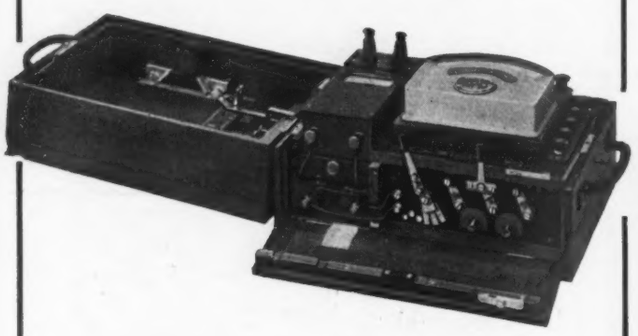
Rear View



**WARD LEONARD ELECTRIC CO.**
BRONXVILLE, N. Y.

# INDUSTRIAL POTENTIOMETERS

**("S-H" Standardizing Set)**



Every Public Service Company needs some ready means of "checking" commercial ammeters, voltmeters and wattmeters. *There is no doubt about it;* but the difficulty has been to secure a testing outfit that could be operated successfully in the Meter Department of a company of *average size* where laboratory experts are not always at hand.

These requirements are now met very perfectly by the *"S-H" Standardizing Set,* manufactured for us by Messrs. Siemens & Halske, A. G.

It is an industrial potentiometer—designed from an *industrial* viewpoint; and with it anyone of ordinary skill can quickly calibrate portable or switchboard instruments, *as accurately as the scales of the instruments under test can be read.*

When A. C. instruments are to be tested, it is necessary to use transfer-standards which read alike on alternating and direct current—exactly as with any other potentiometer.

The "S-H" Standardizing Set and other precision instruments made by Siements & Halske are described in our *Catalogue* 771.

If the subject interests you, write for a copy today.

Correspond with us before buying Electrical Measuring Instruments for any purpose whatever. We are the leading importers of such apparatus.

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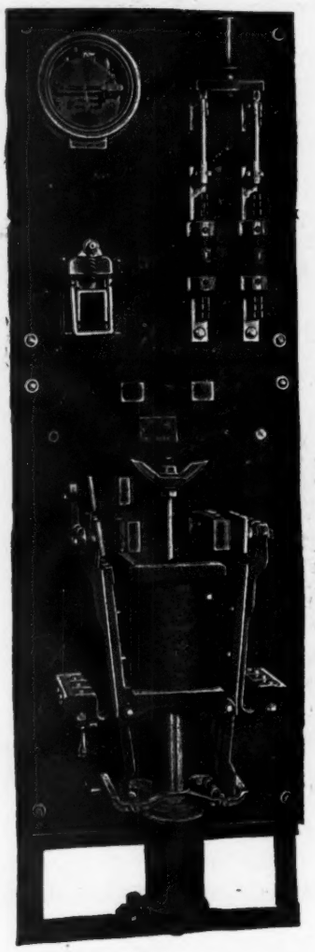

# Space, Labor and Expense are Saved

by this Sundh 50 HP. 220-volt Controlling Panel—a combination of a Sundh Automatic Starter with main line switch and fuses and a Sundh Pressure Regulator.

There are no sliding contacts to stick or get out of line. The entire outfit is the embodiment of simplicity, strength and reliability.

Send sketch or blueprint, with specifications, and we will quote.

Meanwhile, ask for the Sundh Catalog.

**Sundh Electric Company**

**New York, U. S. A.**

3

# A FREE SAMPLE

Trade No. P & S 452
Standard Package 250,
Schedule "B."
List Price each 44 cents

P&S 452 is a new key receptacle with base for surface wiring. The shell is the well known FLUTO Interchangeable style.

Holes for supporting screws are spaced 2⅛ inches on centers.

We will be very pleased to submit free sample for your examination.

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## "Multi" Fuses Are The Best Refillable Fuse Made ToDay

Accurate in rating, reliable under all conditions of service. Free of infringements and protected by pending patents.

**MR. DEALER—HOW MANY FUSES**

have *YOU* sent back to the Factory to be refilled. Why not give your customers what they want, a Fuse that can be PROPERLY refilled and supply his wants for a PROPER Refilling Material.

Send for Catalogue today.

**Multi Refillable Fuse Co.** 817 Washington Blvd. Chicago, Ill.

## DAUM REFILLABLE FUSES

Refilled by simply bending the fuse over the metal cross piece and screwing the cap in place.
No threads on the fibre tube to strip off or screws, rivets or clamps to get loose. Merely two holes in the fibre tube and held in place by the cap. This metal to metal contact is not affected by the swelling or shrinking of the fibre shell.
Have you tested your samples yet?
Daum Fuses are making good every day.
Catalogue No. 17 for the asking.
Sole Manufacturers

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## DUNCAN PRODUCTS
### ARE ALWAYS IN DEMAND

**TRANSFORMER**

**D. C. METER**

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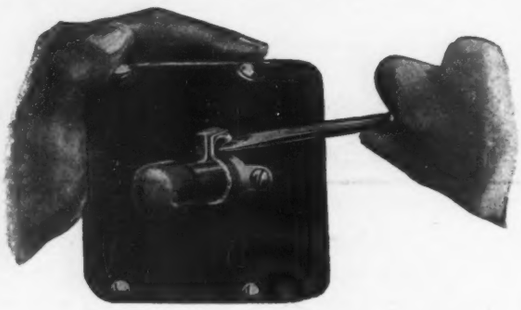
**DUNCAN ELECTRIC MFG. CO., Lafayette, Ind.**

# *It saves your time*



The Federal Bonding Clamp does away with the necessity of threading dummy or gas pipe three or four inches and can be instantly installed. It fastens the outlet box firmly at right angles to dummy and gives a perfect ground connection. The open space around the pipe is closed, preventing danger of fire in case of short circuit. Write for free sample.

## Time and Labor Saved With Federal Bushings

Federal Bushings and Sockets lock rigidly by the turn of a clamping ring and will not turn after being installed. Central Stations and contractors can do better work in less time with Federal Bushings — they save time, labor and money If not now using the Federal line, you should obtain full information.

***Ask for Bulletin 8178***
***It describes the Federal Line***

TRADE MARK

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# The Enclosed Fuse

UNION

is a small article but it often protects apparatus of a thousand times its own value. Hence the importance of using a dependable fuse.

"UNION" Fuses are specified because they are safely designed and well made, and years of satisfactory service prove these facts.
Are you using them?

UNION

**Chicago Fuse Mfg. Co.**
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**Accurate, Compact, Inexpensive**
VOLTMETERS, AMMETERS and VOLT-AMMETERS
*Send for complete catalog*
**LOUIS M. PIGNOLET**
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**Pocket** Voltmeters, Ammeters, Volt-Ammeters
Lamp Testers, Miniature Switchboard Instruments.
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# STERLING
Switchboards—Panelboards—Knife Switches—Iron Boxes
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**DEPENDABLE ACCURACY**
is an inherent characteristic of
**Kermel Instruments**
The line includes: Volt-meters, volt-ammeters, ammeters and hot wire meters. Write for catalog.
**KERMEL APPARATUS CO.**
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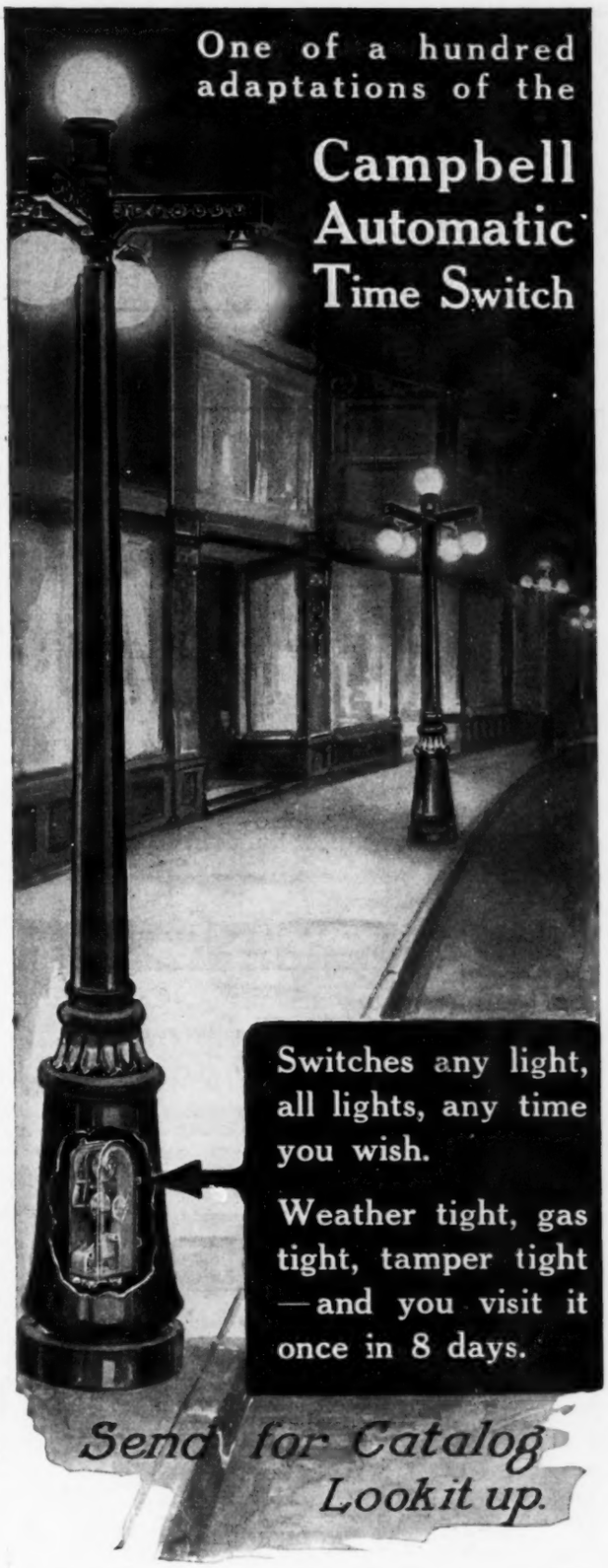
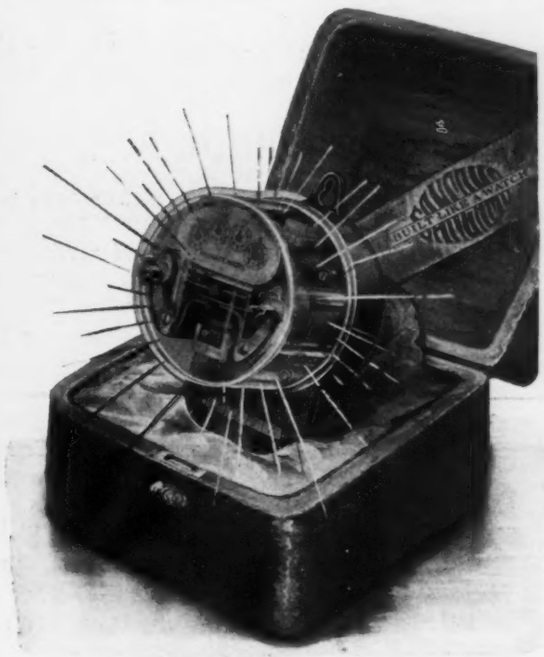

One of a hundred adaptations of the
Campbell Automatic Time Switch
Switches any light, all lights, any time you wish.
Weather tight, gas tight, tamper tight —and you visit it once in 8 days.
Send for Catalog
Look it up.

**Campbell Electric Co.**

**LYNN, MASS.**



# A Jewel of a Meter

is the most important consideration, and one which has been successfully met in the design of the

## Sangamo Induction
### Type H
## Watthour Meter

the jewel of which is lighter—smaller than in any other meter—literally a **little** jewel. In testing and analyzing sapphire for use in Sangamo meters highly developed microscopic methods are followed to insure the highest quality of jewels, and the elimination of possible substitution of other stones resembling sapphire but inferior in hardness.

Great care is used in measuring the sapphire cups, for curvature, perfection of polish, accuracy of mounting in the jewel bearing—three inspections are made before mounting and two after mounting.

The jewel in the Type H meter is protected by a sleeve or cap leaving a small opening around the pivot, which, together with the proximity of the disc above the jewel bearing, effectually prevents the entry of dust or dirt to the bearing.

Sangamo Type H Meters are "Built like a watch" and run like a watch. If your old meters are run down or playing truant learn about the "Jewel of a meter" by asking for our trade literature.

**Sangamo Electric Company**
**Springfield, Illinois**

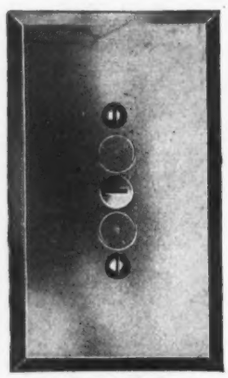
# THE EARMARKS OF A GOOD WIRING JOB

is the installation of

## "Diamond H" Switches and Receptacles

They make contractors' profits *real* profits by avoiding costly kicks such as make defective mechanisms turn profits into losses.

Different in construction from all others—H switches and receptacles are stronger, surer, safer.



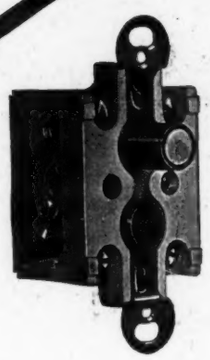
Flush Receptacle with Plug Withdrawn

H Receptacles are the *only* receptacles that automatically close the holes in the face of the plate, when the plug is withdrawn.

All wearing parts made of the finest case hardened tempered steel, blued so it will not rust.

H Switches have liberal porcelain bases completely enclosing all mechanism, so that no dust or dirt can get in. Sheet mica exclusively insulates the mechanism.

The new H catalog is ready to mail. It shows over 70 styles. Write for it.



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# MITCHELL-RAND INSULATION

## INSULATING COMPOUNDS

Our factory is fitted to make for you any style of wax, pitch or asphalt composition in **barrel lots** or in **car loads.**

Let us be your compounding department.

By having us do this work for you you save time and trouble, reduce fire risk, save interest on crude materials in stock, save space and melting equipment.

Others have found it advantageous to employ us—you had better give the matter your consideration.

**Mitchell-Rand Mfg. Co.**
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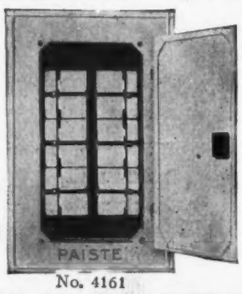
**Electrical Insulating Materials of All Kinds**

## Sectional Steel Panel Boxes




No. 4161

have so many good points tied up in the one thing it will pay you to look into their make-up and price. We make all kinds and sizes for either Flush or Surface Work, Panel Cut-outs, Plug Cut-outs and Panelettes. Are you on our mailing list for booklets and catalogs? Let us know.

**H. T. PAISTE CO., Philadelphia, Pa.**
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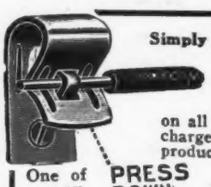


**Simply Press Down Spring, Insert Wire and Let Go**
That's why you should insist on having
**FAHNESTOCK**
**SPRING BINDING POSTS**
on all the electrical devices you buy (without extra charge) and why manufacturers put them on their products (gratis).

**FAHNESTOCK ELECTRIC COMPANY**
**129 Patchen Avenue Brooklyn, N. Y.**

Recording Gauges

**FOXBORO**
TRADE MARK
Indicating and Recording
Gauges—Thermometers—Tachometers—Pyrometers

**STAND THE TEST OF SERVICE**

Write for Bulletin No. 65

**The Industrial Instrument Co.**
New York **Foxboro, Mass.** Chicago

Presturn Pull
No. 3000

## You'll Never Have Trouble with Hubbell

# Presturn Sockets

## PULL, KEY AND KEYLESS

Presturn Keyless
No. 3020

YOU'LL *never* have trouble—that's a broad statement, long on fact. Trace the trail of Hubbell Sockets back through their years of existence. Name if you can any building where Hubbell Sockets properly wired and installed have failed to face their duty and perform perfectly.

Knowledge of the needs of Dealers, Contractors, Architects and Building Owners, common sense and uncommon skill are the things that have been and always will be applied to the making of Hubbell Pull, Key and Keyless Sockets.

The idea is not to make Hubbell Sockets better than they ought to be, but as good as they *must* be to satisfy not alone the Dealer or Contractor, but the man whose money keeps us all in business—the *ultimate consumer*.

The new line of Hubbell Sockets with Presturn Shells offers ample evidence that the ability to create, make and improve is earned by experience—not inherited or bought.

Wherever there is room to improve Hubbell Sockets it is never neglected. Presturn Shells mark a forward step in socket security, protection and adaptability.

The Presturn Shell doesn't slight one place to make another secure. Nineteen projections in the cap are gripped by a like number of slots in the base. The cap cannot rock or work out of the slots. The all-round, nineteen-grip security resists any weight or strain, no matter at what angle the socket is placed.

Presturn Shells for Pull, Key and Keyless Sockets interchange throughout a complete line of bases for surface, cleat and moulding work.

No. 3069

No. 3067

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No. 3072

Hubbell Sockets, the good old reliables with the new Presturn Shells, are ready for you. Write for free sample, also copy of Bulletin 14-9.

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R. E. T. PRINGLE, 95 King Street, East, TORONTO

The Standard Insulators for transmission lines—telephone, telegraph and electric light service.

**"Pittsburg" Insulators**

are absolutely dependable wherever porcelain is required and are replacing glass on all reliable telephone and telegraph lines. The transmission of power at very high voltages is made possible by the use of "Pittsburg" Porcelain.

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**The Uniform Cold Drawn Steel Cap Used On**

**B & K**

**Wood Strain Insulators**

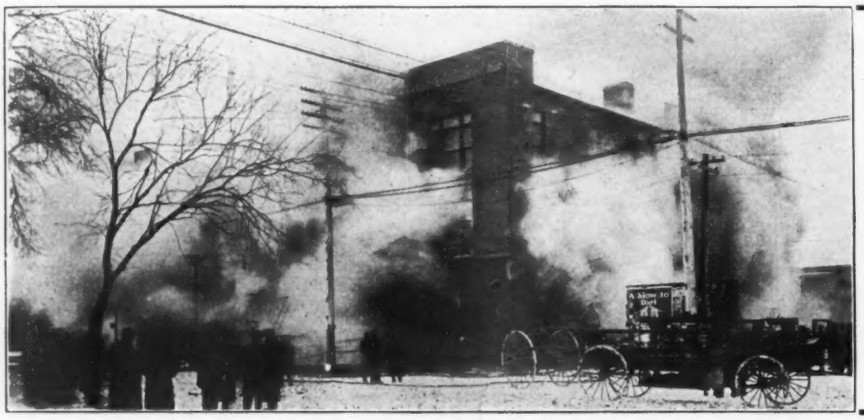
are swedged into position under great pressure. The eye is electrically forged into the cap, and the whole construction tends to eliminate fractures due to sudden shocks by trolley poles, etc.

Tests show that these caps hold up to the breaking point of the wood, without distortion.

Write for the B & K Catalogue of pressed steel line specialties.

**The Barnes & Kobert Mfg. Co.**

141 Brewery Street New Haven, Conn.



*Pyrene* TRADE MARK

**FIRE EXTINGUISHER**

It prevents fire damage by conquering incipient fires is the POLICY

**PYRENE Mfg. Co.**

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Atlanta, Baltimore, Boston, Buffalo, Chicago, Dayton, Denver, Louisville, Memphis, Norfolk, Oklahoma City, Pittsburgh, St. Louis, San Antonio, York, Neb. Pacific Coast Distributors: GORHAM ENGINEERING CO., San Francisco, Los Angeles, Seattle

"THESCO"

Vertical Wire Clamps

will fasten any conductor, up to 1¼" diameter, to any ordinary sized insulator. And they won't break the insulators either—the single bolt takes care of that.

Write for particulars and prices.

**The States Company**

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1

**Anderson Time Switches**

combine all good features of switch manufacture

Albert & J. M. Anderson Mfg. Co.

289-293 A Street Boston, Mass.

2

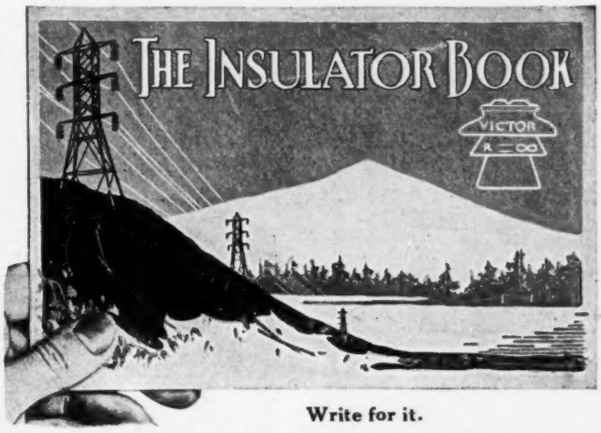
**SWITCHBOARDS**

AND ACCESSORIES WALKER ELECTRIC CO. PHILADELPHIA

## When President Wilson Touched the Button

that blew up the Gamboa dike, he united the Atlantic and Pacific oceans at Panama. The 45,000-Volt Canal Power Line from ocean to ocean is carried on—

# "Victor" Insulators




Write for it.

They are almost invariably chosen by the big transmission lines, here and abroad, including the highest voltage line in the world (150,000 volts). Insulators leave our big plant only after severe tests to determine their uniformity, hence the unvarying satisfaction they give. We have a type for every service in all climates. Ask for "The Insulator Book."

**The Locke Insulator Mfg. Co.**

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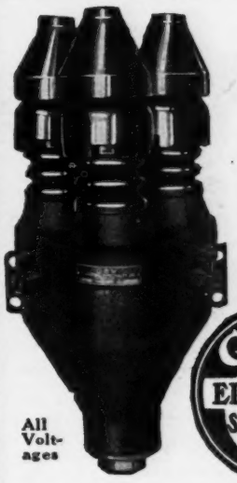

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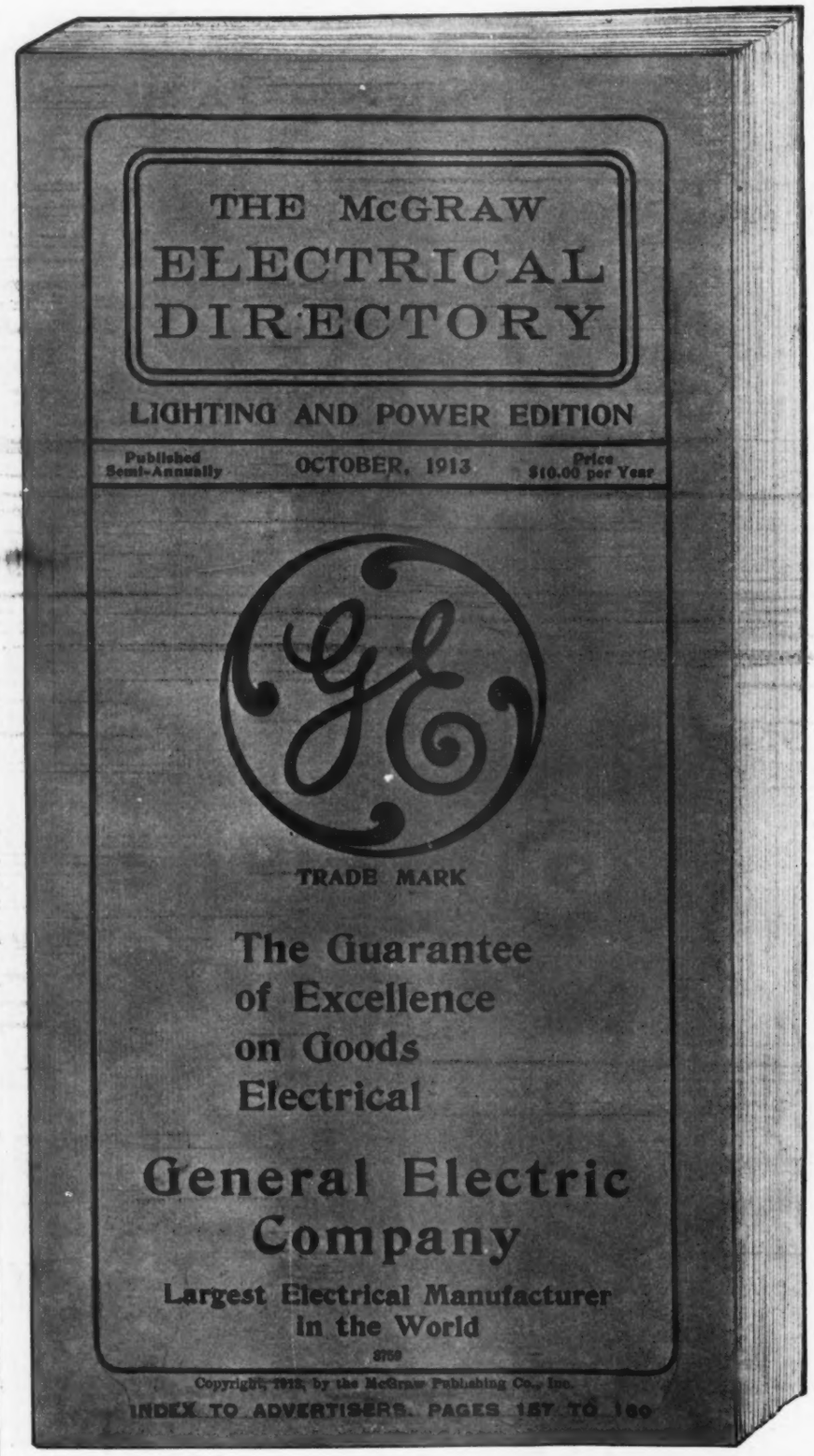


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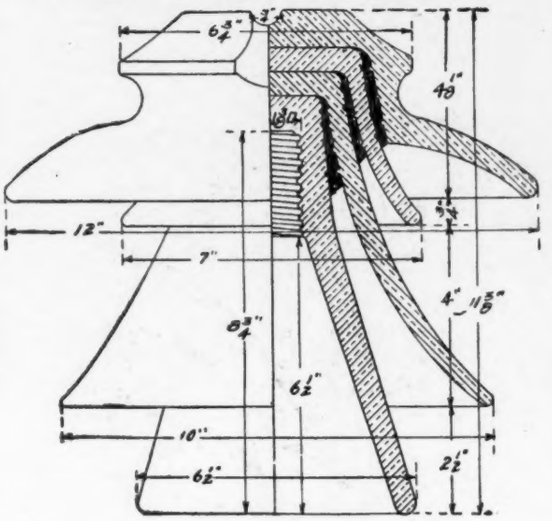

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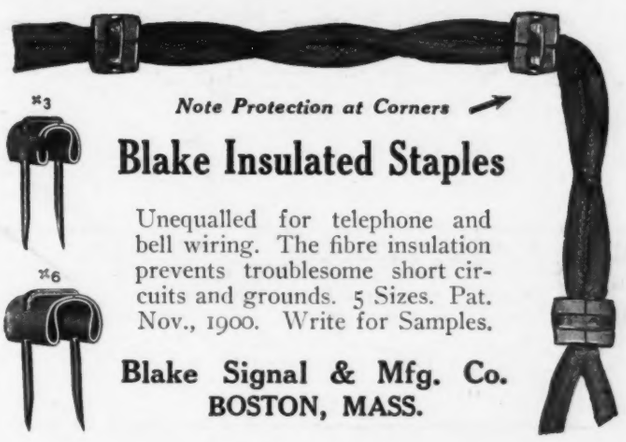

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They are built *right*, through and through, for highly efficient, durable service. Their ideal construction and the high-grade materials used, insure low core and copper losses and low temperature rise. The cores are of Silicon Steel, insulated with *Packard Insulation*, then vacuum dried and impregnated with an absolutely oil-proof compound.

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Write for our bulletin No. 200—*now* before you forget it.

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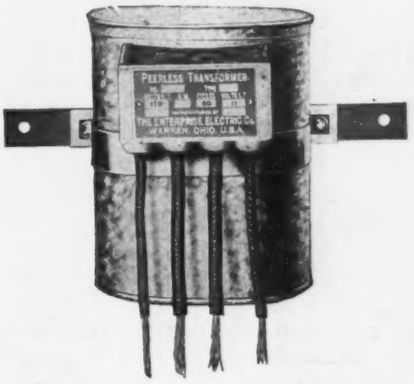
# An Argument That Sells Signs

Tell your prospective sign customer that besides furnishing him with a striking sign at a reasonable price you will save him 75% of the current cost. That argument will interest him and help land the order. This big saving is accomplished by using 5-watt tungsten sign lamps in connection with—

# "PEERLESS" Sign Lamp Transformers

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This system requires about 25% as much current as carbon sign lighting systems. It gives exact rated voltage, uniform light, longer burning life and better satisfaction in every respect.

Ask for prices and particulars.

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by using

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Self Cooled, Oil Filled

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The cost of cooling systems in conjunction with transformer installations is an expense in first cost and maintenance which, while sometimes indispensable in many cases can be obviated without sacrificing transformer efficiency.

**Note This Transformer Construction**

The case is of finest grain cast iron top and bottom, which surrounds a number of large steel corrugations running vertically from top to bottom and cast directly into the base. The case is oil filled.

During operation the heated oil rising to an upper level heats the adjacent air in the corrugations causing a chimney effect from the resulting draft.

**The temperature rise in these transformers is remarkably low.**

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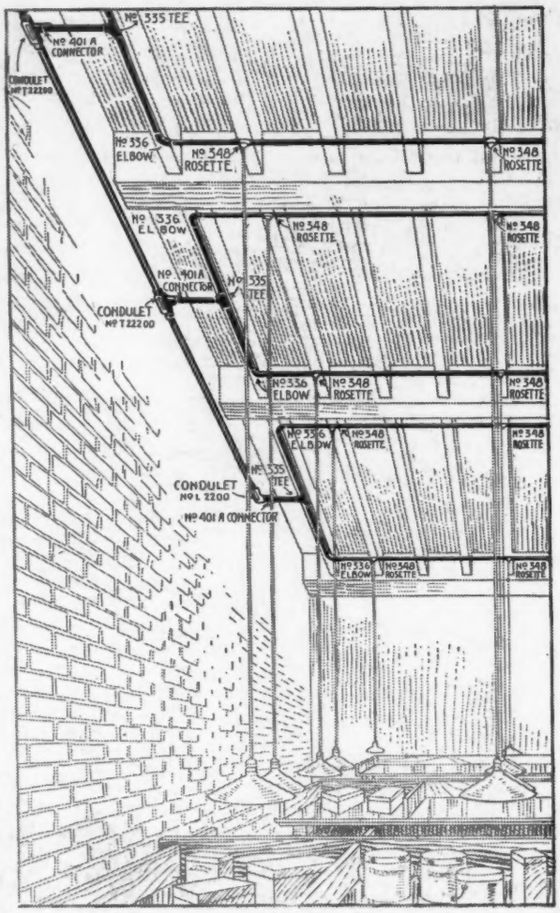



# Metal Molding in Factories

Park Davis & Co. added another large building to their Detroit, Mich., plant a few months ago. This building was of the type which has called for rigid conduit during the last few years,—"semi-mill constructed,"—but only a small part of the wiring was done in conduit.

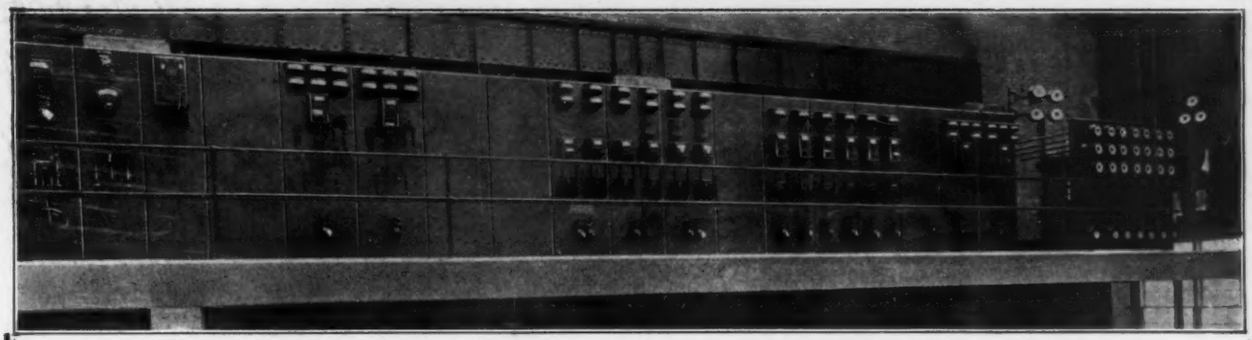
The greater part of it was done with "National" Metal Molding in the way indicated in the cut above.

Circuits were distributed in one inch conduit to each bay and tapped off in "National" Metal Molding with Condulets. No. 348 One Piece Rosettes were used to take off reinforced drop cords.

**"National" Metal Molding was used instead of conduit because drops could be added in or relocated to meet constantly changing conditions without tearing down half the run and interfering with half the employees in a room.**

## National Metal Molding Co.

**PITTSBURGH, PA.**



Switchboard of Elkhart Hydraulic Co., Elkhart, Ind., made of J-M Transite Ebony Asbestos Wood

# J-M TRANSITE EBONY ASBESTOS WOOD

**Was used for this big switchboard because:**

—It has a dielectric strength of 76,000 volts for 1-in. thickness.

—Its insulation resistance is 80,000 megohms for 2-in. thickness.

—It is unaffected by immersion in water for an indefinite period.

—It is absolutely free from metallic veins or other foreign conducting substances.

—It is non-fragile; a hammer blow will not shatter it; does not break in transportation.

—It weighs only 121 lbs. per cubic foot, while soapstone, slate and marble weigh about 180 lbs.

—It is fireproof; takes a smooth finish; and can be sawed and drilled with greater facility and better results than the materials named above.

Write our nearest Branch for interesting Booklet.

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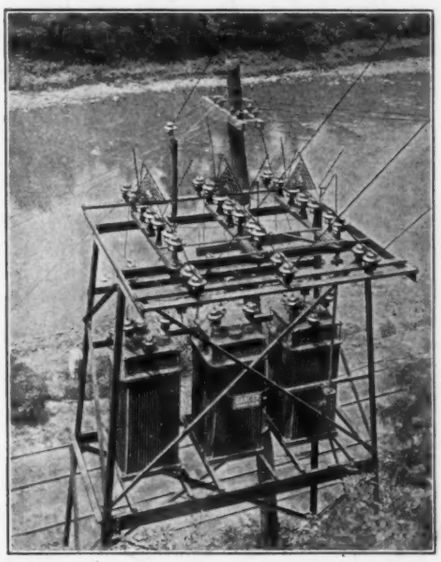

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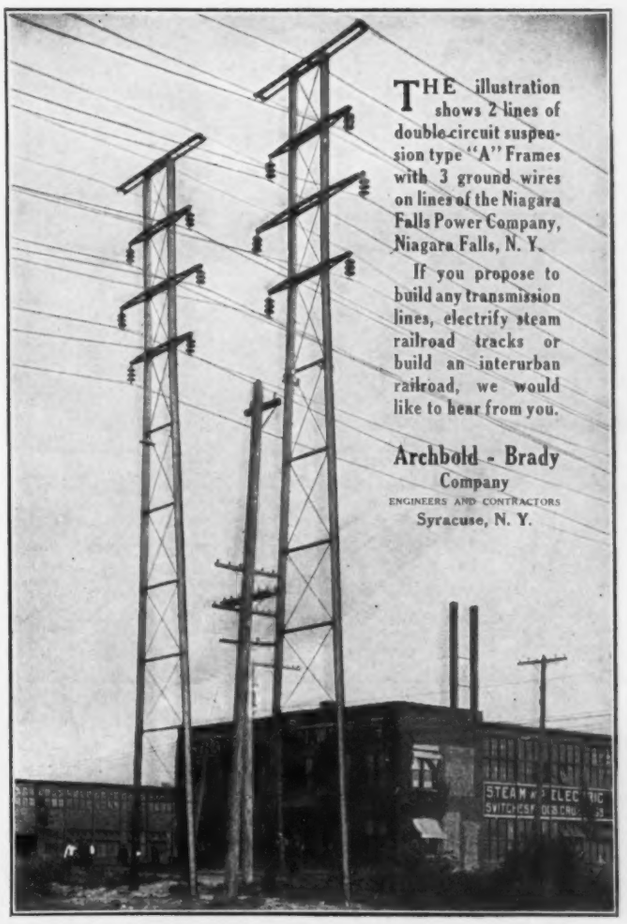

THE illustration shows 2 lines of double-circuit suspension type "A" Frames with 3 ground wires on lines of the Niagara Falls Power Company, Niagara Falls, N. Y.

If you propose to build any transmission lines, electrify steam railroad tracks or build an interurban railroad, we would like to hear from you.

**Archbold - Brady Company**
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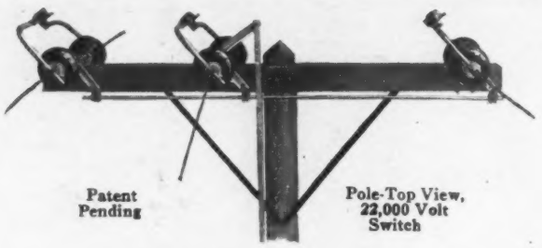


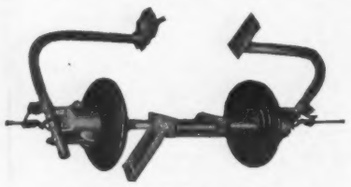
Patent Pending

Pole-Top View, 22,000 Volt Switch

# The K-P-F Switch

is a type of high-tension disconnecting switch that has fewer parts, is more rugged, and can be installed with less labor and less material.

With the K-P-F type you sectionalize a line by dead-ending the line wires on suspension-type insulators. The switches installed at these points use the same insulators to carry the contacts by means of which the circuit is opened or closed.



22,000-Volt Switch, Open

Means are provided for locking the switch in either position, and the contacts can't stick.

*Ask for Bulletin 102* that describes the many advantages of the K-P-F and tells why you should use it on your transmission line.

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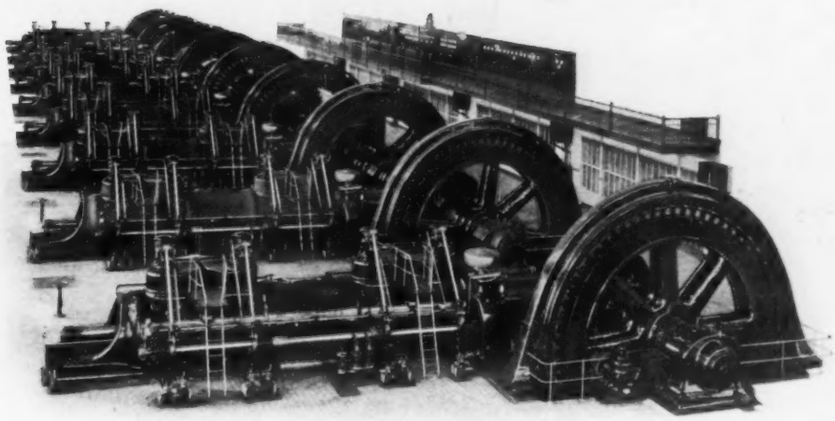

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During the new year let the Type "H" Transformer help to establish your record of service rendered.

# General Electric Company

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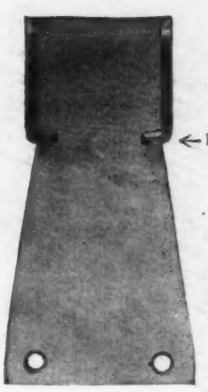
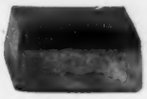
The Trade Mark of the Largest Electrical Manufacturer in The World.

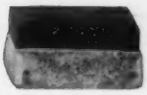


Sloping sides of holder prevent carbon from falling forward.
←Lugs prevent carbon dropping.

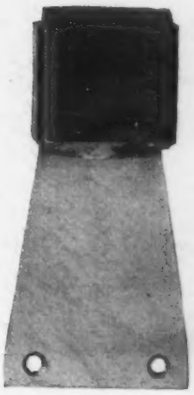
Carbon shaped to fit holder.



Carbon after copper plating.



Carbon after tinning.



# Fitted—Tinned—Sweated Secondary Contacts for G-E Circuit Breakers

No part of a circuit breaker is of more importance than the carbon or "secondary" contacts. They must protect the main brush against destruction and also withstand hard usage whenever the breaker is operated.

They are given a severe shock every time the breaker is slammed in by the operator.

They are subjected to the destructive effect of the arc every time the breaker opens under load.

The loosening or breakage of the carbons either reduces or destroys the usefulness of the breaker.

These facts make it essential that the secondary carbon contacts be made of the best available material, so arranged as to give low resistance joints and serviceable construction.

**All** G-E circuit breaker secondary contacts consist of specially selected and accurately shaped carbon blocks, copper plated, tinned and sweated to the holders. The holders are of such shape that the carbons could not fall out even if they became loose.

This style of carbon secondary and method of fastening to the holder is found **only** in G-E circuit breakers. It reduces both the resistance of the secondary current path and the possibility of carbon breakage, to the lowest degree.

When you buy circuit breakers insist that they have solid carbon secondary contacts tinned and sweated to the holders.

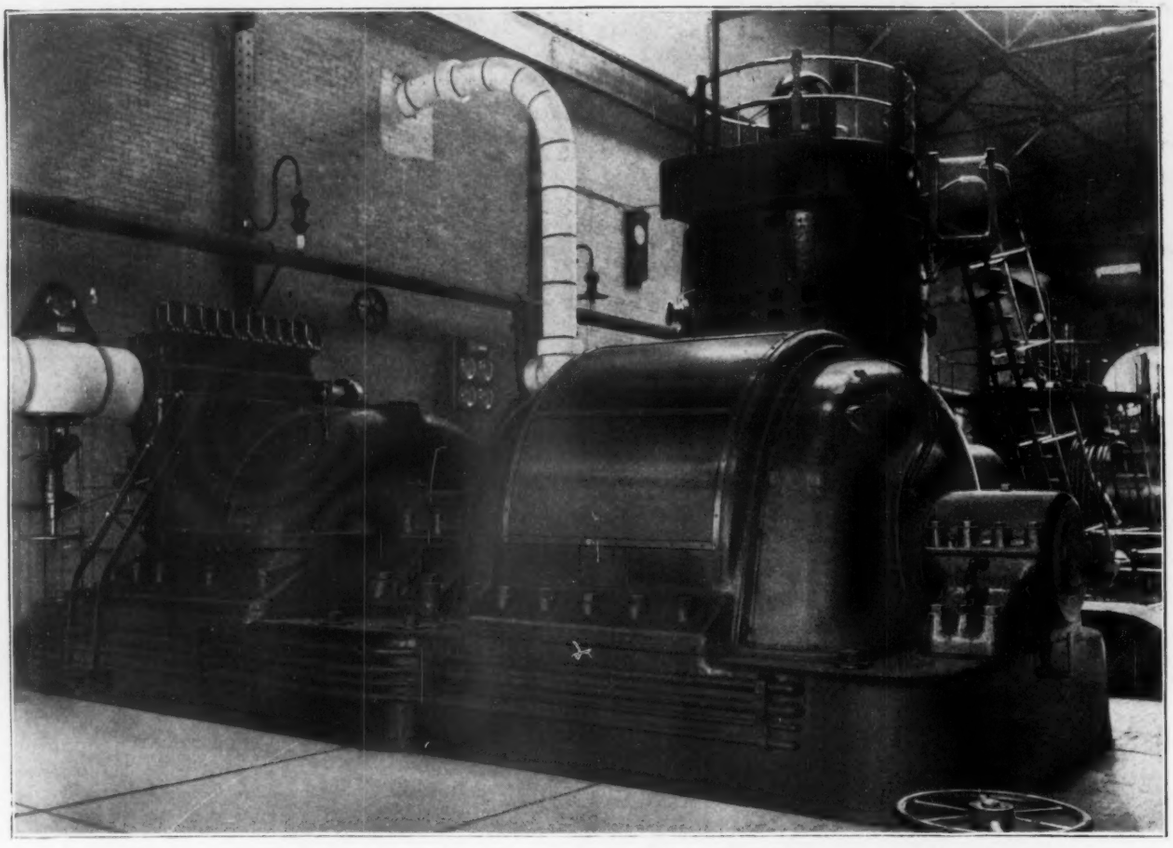
# General Electric Company

**List of Sales Offices on Second Page Before Editorial Section**

4266

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.



**5000 Kw. Curtis Steam Turbine, Terre Haute, Indianapolis and Eastern Traction Co.**

# Ready for Service 14 Days After Shipment

The 5000 Kw. Curtis Steam Turbine shown above was shipped from Schenectady November 27th and was ready for service in Terre Haute, Ind., December 11th—just 14 days afterwards.

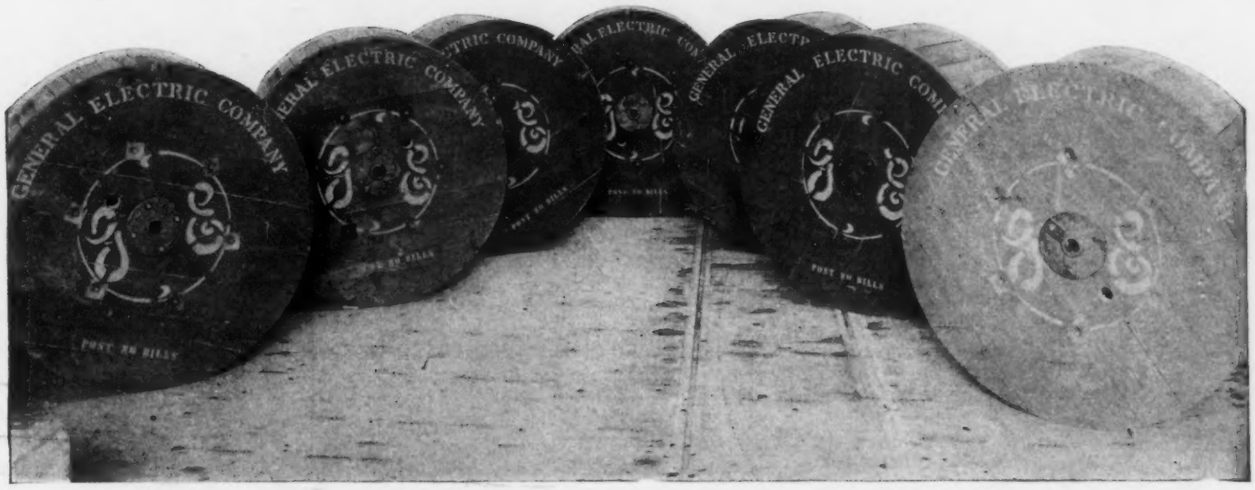
The thorough testing of all Curtis turbines before shipment and the absence of any fine adjustments not only make possible a record like this, but insure the satisfactory operation of the unit thereafter.

# General Electric Company

**List of Sales Offices on Second Page Before Editorial Section** 4707

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.




# Paper Insulated Cables

The General Electric Company manufactures high tension and low tension paper insulated cables, finished either plain lead covered, or with band steel armor for installation without conduit.

Eighty-five miles of 25,000 volt three phase G-E Cable are now giving satisfactory service.

# General Electric Company

List of Sales Offices on Second Page Before Editorial Section

4501

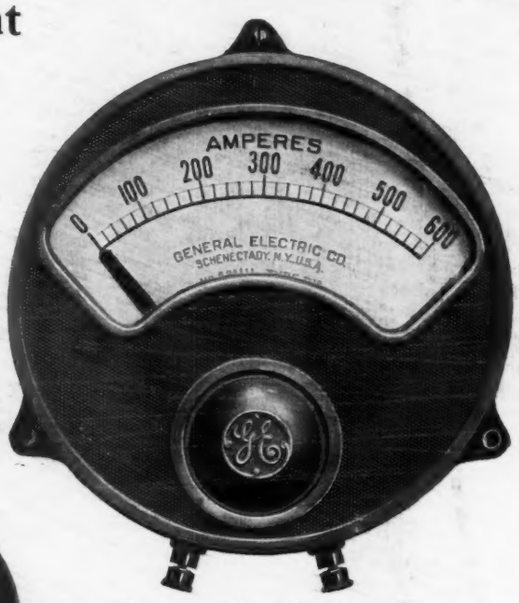
This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

# G-E Direct Current Instruments

## Permanent Magnet Type

Back connected round pattern switchboard instruments, voltmeters and ammeters. Made in two sizes, 7¼ and 9½ inches in diameter.




Front connected round pattern wall type voltmeters and ammeters. Made in two sizes, 7¼ and 9½ inches in diameter.

Automobile volt-ammeter with clock. Also used for small switchboards. Instruments can be furnished with or without clock.

Portable ammeters, voltmeters, milammeters and milli-voltmeters.

Portable shunt for use with millivoltmeter for measuring current, furnished with single, double or triple capacity.

**Pocket volt-ammeter, has three voltage ranges 1.5-15-150 or 3-30-150 volts. Current ranges, .15-1.5-15 or .3-3-30 amperes.**

# General Electric Company

**List of Sales Offices on Second Page Before Editorial Section** 4427

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.

**This page is prepared for the ready reference of the readers of the Electrical World. To insure correspondence against avoidable delay, all communications to the company should be addressed to the sales office nearest the writer.**

# General Electric Company

## Sales Offices

ATLANTA, GA., Third National Bank Building.
BALTIMORE, MD., Electrical Building.
BIRMINGHAM, ALA., Brown-Marx Building.
BOISE, IDAHO, Idaho Building.
BOSTON, MASS., 84 State Street.
BUFFALO, N. Y., Electric Building.
BUTTE, MONTANA, Electric Building.
CHARLESTON, W. VA., Charleston National Bank Bldg.
CHARLOTTE, N. C., Commercial National Bank Bldg.
CHATTANOOGA, TENN., James Building.
CHICAGO, ILL., Monadnock Building.
CINCINNATI, OHIO, Provident Bank Building.
CLEVELAND, OHIO, Citizens Building.
COLUMBUS, OHIO, Columbus Savings & Trust Bldg.
DAVENPORT, IOWA, Security Building.
DAYTON, OHIO, Schwind Building.
DENVER, COLO., First National Bank Building.
DETROIT, MICH., Dime Savings Bank Bldg. (Office of Agent)
ELMIRA, N. Y., Hulett Building.
ERIE, PA., Marine National Bank Building.
FORT WAYNE, IND., Fort Wayne Works.
HARTFORD, CONN., Hartford National Bank Bldg.
INDIANAPOLIS, IND., Traction Terminal Building.
JACKSONVILLE, FLA., Herd National Bank Bldg.
JOPLIN, MO., Miners' Bank Building.
KANSAS CITY, MO., Dwight Building.
KEOKUK, IOWA, Monarch Building.
KNOXVILLE, TENN., Bank & Trust Building.
LOS ANGELES, CAL., 124 West Fourth Street.
LOUISVILLE, KY., Starks Bldg.
MADISON, WIS., Fort Wayne Works.
MEMPHIS, TENN., Randolph Building.
MILWAUKEE, WIS., Public Service Building.
MINNEAPOLIS, MINN., 410 Third Ave., North.
NASHVILLE, TENN., Stahlman Building.
NEW HAVEN, CONN., Second National Bank Bldg.
NEW ORLEANS, LA., Maison-Blanche Building.
NEW YORK, N. Y., 30 Church Street.
NIAGARA FALLS, N. Y., Gluck Building.
OMAHA, NEB., Union Pacific Building.
PHILADELPHIA, PA., Witherspoon Building.
PITTSBURG, PA., Oliver Building.
PORTLAND, ORE., Electric Building.
PROVIDENCE, R. I., 1210 Turks Head Bldg.
RICHMOND, VA., Railway and Power Building.
ROCHESTER, N. Y., Granite Building.
SALT LAKE CITY, UTAH, Newhouse Building.
SAN FRANCISCO, CAL., Rialto Building.
SCHENECTADY, N. Y., G-E Works.
SEATTLE, WASH., Colman Building.
SPOKANE, WASH., Paulsen Building.
SPRINGFIELD, MASS., Massachusetts Mutual Bldg.
ST. LOUIS, MO., Pierce Building.
SYRACUSE, N. Y., Onondaga County Savings Bank Bldg.
TOLEDO, OHIO, Spitzer Building.
WASHINGTON, D. C., Evans Building.
YOUNGSTOWN, OHIO, Wick Building.

For TEXAS, OKLAHOMA and ARIZONA Business refer to Southwest General Electric Company (formerly Hobson Electric Co.)
DALLAS, TEX., Ross and Market Sts.
HOUSTON, TEX., Third and Railroad Streets.
EL PASO, TEX., 500 San Francisco Street.
OKLAHOMA CITY, OKLA., Insurance Building.

For all CANADIAN Business refer to CANADIAN GENERAL ELECTRIC Co., Ltd., Toronto, Ont.

For all incandescent lamp business refer to EDISON LAMP WORKS of General Electric Company, Harrison, N. J., or NATIONAL LAMP WORKS of General Electric Company, Cleveland, Ohio.

### FOREIGN OFFICES OR REPRESENTATIVES:

**Argentina:** Buenos Aires; **Uruguay,** Montevideo; **Australasia:** Adelaide, Auckland, Brisbane, Dunedin, Melbourne, Perth, Sydney; **Brazil:** Bahia, Rio de Janeiro, Sao Paulo; **Chili:** Iquique, Santiago, Valparaiso; **China:** Canton, Hongkong, Pekin, Shanghai; **Colombia:** Barranquilla; **Costa Rica:** San Jose; **Cuba:** Havana; **England:** London; **India:** Calcutta; **Japan:** Moji, Osaka, Tokyo, Yokohama; **Korea:** Seoul; **Manchuria:** Dairen; **Mexico:** Mexico City, Guadalajara; **Peru:** Lima; **Philippine Islands:** Manila; **South Africa:** Capetown, Durban, Johannesburg.

## General Offices, Schenectady, N. Y.

### Products and Purpose

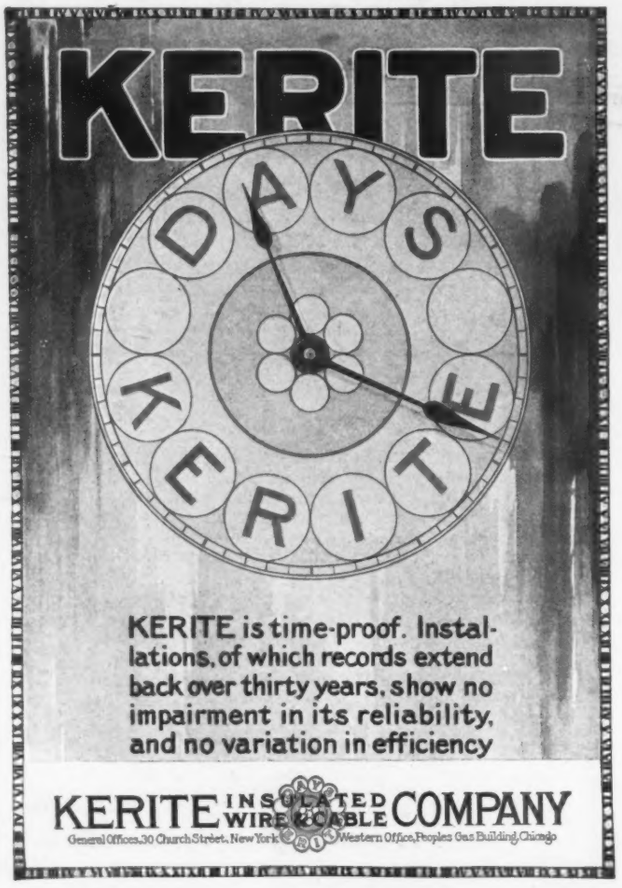
**The General Electric Company is the largest electrical manufacturer in the world. With few exceptions its products comprise every kind of apparatus and machinery used in the generation, transmission, distribution and use of electrical energy. Its thousands of products, in use in all parts of the world, have established the G-E Trade Mark as the Guarantee of Excellence on Goods Electrical. As in the past the General Electric Company will continue to be foremost in all developments and improvements tending toward the perfection of present electrical service and its extension into new fields of usefulness.**

4526

**Member of the Society for Electrical Development, Inc.**

**"DO IT ELECTRICALLY"**

This Trade Mark The Guarantee of Excellence on Goods Electrical.

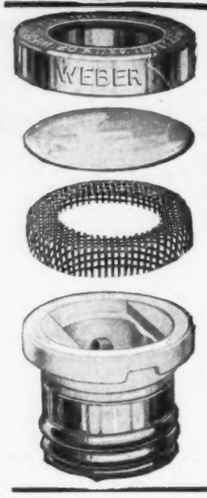

KERITE
DAYS
KERITE
KERITE is time-proof. Installations, of which records extend back over thirty years, show no impairment in its reliability, and no variation in efficiency
KERITE INSULATED WIRE & CABLE COMPANY
General Offices, 30 Church Street, New York
Western Office, Peoples Gas Building, Chicago

# WEBER FUSE PLUGS

Superior to All Others

Uniform in Rating

Reliable Under Short Circuit




Weber Fuse Plugs are made without vent-holes. The right-angled band of fine wire gauze between porcelain and mica cap effectively checks the force of the explosion and prevents the escape of flaming gases when the fuse blows. The action may fairly be compared to that of the automobile muffler.

*Always specify* **WEBER**
*Accept no substitutes*

For sale by

**ALL JOBBERS OF ELECTRICAL SUPPLIES**

Henry D. Sears, General Sales Agent, 131 State St., Boston, Mass. 1

OKONITE

TRADE MARK REG. U.S. PAT. OFF.

## The STANDARD for RUBBER INSULATION

***OKONITE INSULATED WIRES AND CABLES***

can be depended upon to meet the most exacting requirements of lighting or power service, economically and profitably.

15

## THE OKONITE COMPANY

253 Broadway, New York

CENTRAL ELECTRIC COMPANY, Chicago, General Western Agents

F.D. Lawrence Electric Co., Cincinnati O.; Novelty Electric Co., Philadelphia, Pa.

Pettingell-Andrews, Boston, Mass..

# The Publisher's Page

*"If times are going to be harder—let's work harder.*

*Let's get up a little earlier in the morning and go to bed a little later at night.*

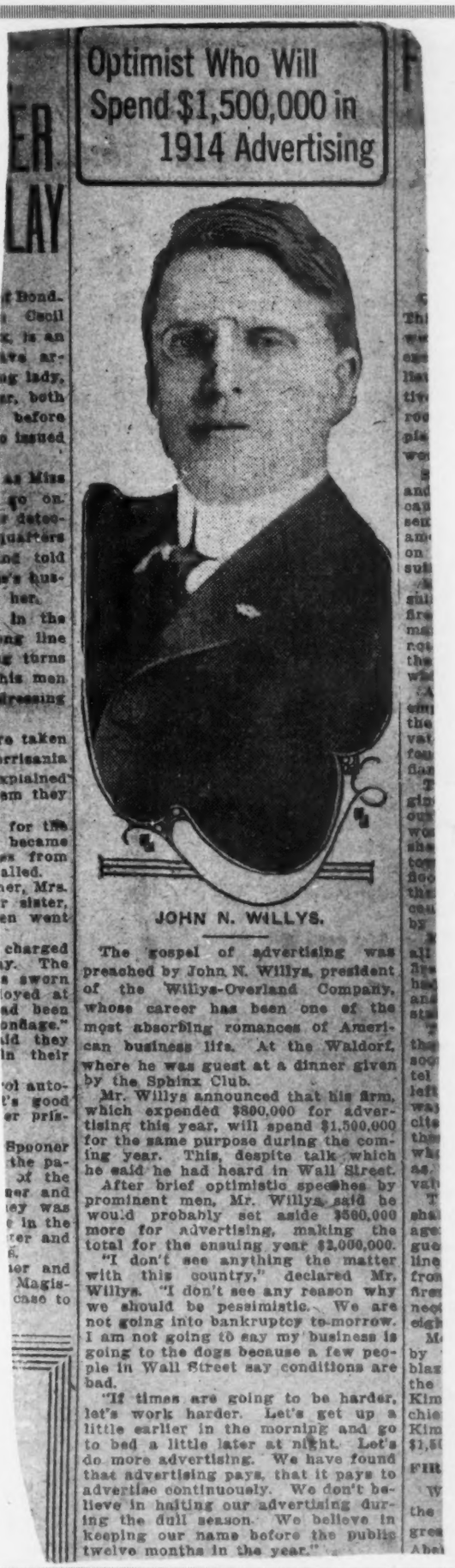
*Let's do more advertising."*

—JOHN N. WILLYS.

Much of the same spirit will be shown by the manufacturers who advertise in the Electrical World.

More advertising means more opportunities for buyers.

Make the Most of It.



**Optimist Who Will Spend $1,500,000 in 1914 Advertising**

JOHN N. WILLYS.

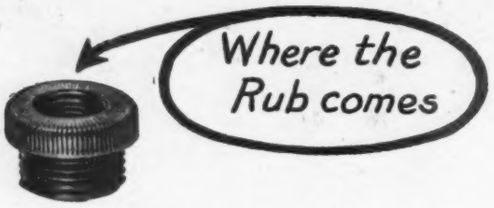
The gospel of advertising was preached by John N. Willys, president of the Willys-Overland Company, whose career has been one of the most absorbing romances of American business life. At the Waldorf, where he was guest at a dinner given by the Sphinx Club.

Mr. Willys announced that his firm, which expended $800,000 for advertising this year, will spend $1,500,000 for the same purpose during the coming year. This, despite talk which he said he had heard in Wall Street.

After brief optimistic speeches by prominent men, Mr. Willys said he would probably set aside $500,000 more for advertising, making the total for the ensuing year $2,000,000.

"I don't see anything the matter with this country," declared Mr. Willys. "I don't see any reason why we should be pessimistic. We are not going into bankruptcy to-morrow. I am not going to say my business is going to the dogs because a few people in Wall Street say conditions are bad.

"If times are going to be harder, let's work harder. Let's get up a little earlier in the morning and go to bed a little later at night. Let's do more advertising. We have found that advertising pays, that it pays to advertise continuously. We don't believe in halting our advertising during the dull season. We believe in keeping our name before the public twelve months in the year."




is just where the cord enters the socket nipple. The only thing that protects your socket and cord is *the bushing;* that is, it should. If it is weak, cracked, loose or unthreaded, you will find it anywhere but where it should be, making the fitting unsafe because unprotected.

## Siemon Solid Thread Socket Bushings

are not that sort. They are, first of all, sound in material; they are soundly made, and have full standard pipe threads clean as a lathe chased screw. They fit, fit truly, and not some of them but all of them.

The price is the same as the "good enough" kind; we pack them in boxes of 100 each. We send you samples, when you say, to try at your convenience. Just say ⅛" or ⅜" and you'll get them quick.

**The Siemon Hard Rubber Corp.**
Bridgeport, Conn.

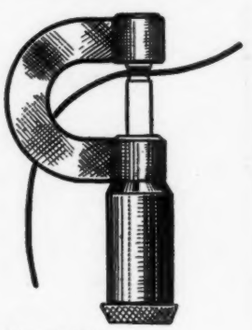
6

# FIELD COILS SOLENOIDS ELECTRO MAGNETS

THE ACME
WIRE COMPANY

NEW HAVEN
CONNECTICUT

## It is Easy to Wind Coils with "Deltabeston" Magnet Wire



The special impregnating and winding apparatus used in its manufacture insures *absolutely uniform* DIAMETER. The importance of this is appreciated by all electrical engineers. "DELTABESTON" has an *unsurpassed heat-resisting insulation* of highest-grade asbestos purified by a special process. Its cost *per year of service* is far lower than that of magnet wire with lower *first* cost. Write today for details and *proof* of its superiority.

DELTABESTON WIRE — REG. U.S. PAT. OFF.

We are the only Manufacturers in the World making Rectangular Asbestos Insulated Magnet Wire.

**D & W FUSE COMPANY, PROVIDENCE, R. I.**

## Roebling Wires

for electrical purposes, include annunciator, office, magnet, weatherproof and rubber covered wire, lamp cord, heater cord, telephone and power cables and other electrical wires,

**John A. Roebling's Sons Co.**
**Trenton, New Jersey**

Your best
Guarantee of the
Satisfactory Insulation **SERVICE**

## WALPOLE TAPE

is the fact that street railways and central stations use more M. C. Tapes than any other brand. They know that it has

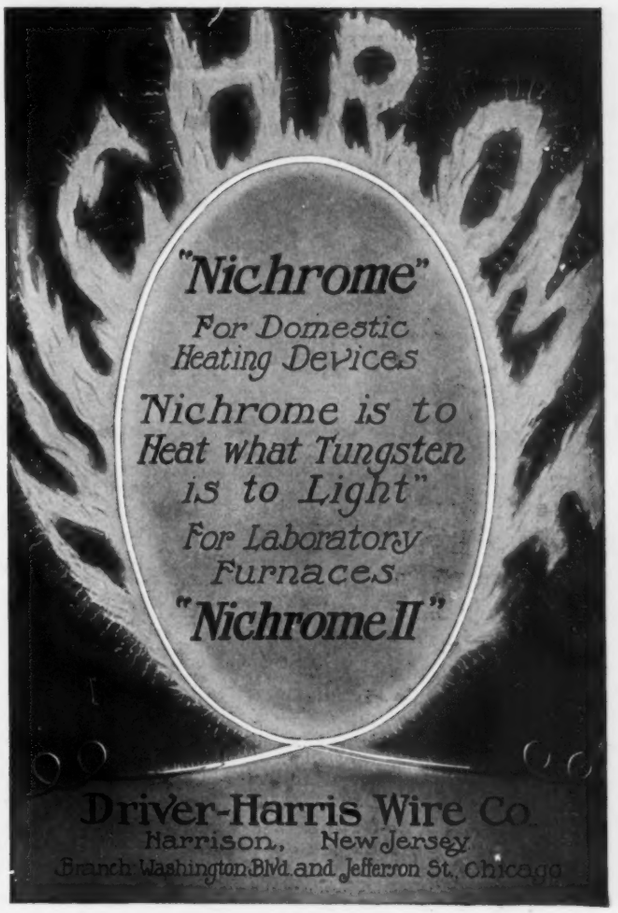
Abundant Insulation
Strong Adhesiveness
Smoothness of Friction
Durability
Strength and
Weatherproofness

**Massachusetts Chemical Co.'s Products**

WALPOLE TIRE & RUBBER COMPANY,
Walpole, Mass.

**Pioneers in Insulation Engineering**

14-138




**PARANITE**

## Rubber Covered Wires and Cables

are made for Underground, Submarine, and Aerial Electric Light and Power Service, and for Telephone, Telegraph, Fire Alarm and Signal Work.
They conform in every respect to the requirements of the New Code Specifications. Best results will be secured if you confer with us before placing your order for wires or cables.

INDIANA RUBBER & INSULATED WIRE CO.
JONESBORO, IND.

1

## ORIGINAL VULCANIZED FIBRE

*Send* us your orders and requests for quotations for

Sheets, Cord Adjusters, Switch Bars, Rods, Magnet Spools, Switch Bases, Tubes, Cleats for Wiring, etc., Saddle Staples, Gears, Switch Handles, Washers, Gear Blanks, Controller Handles, Discs and other special shapes.

Send us your blue prints, sketches, gauges or samples of special machined parts to be made from *Vulcanized Fibre*, and we will fill your orders or quote you, making reasonable prices, and promising you a high standard of accuracy in the work.

**AMERICAN VULCANIZED FIBRE CO.**
**Wilmington, Del.**

Cotton, Silk, Enamel, and Combination

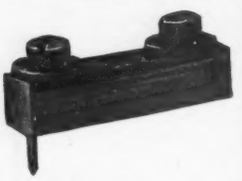
## Magnet Wires

Large Stocks. Prompt Shipment
Coils wound to your specifications

American Enameled Magnet Wire Co.
MUSKEGON, MICH.

## EUREKA Fibre Insulators and Terminal Blocks

≡The World's Best≡
STANDARD in all Correct Construction



**EUREKA Insulated Nails** are extensively employed by the leading Telephone Companies. **EUREKA Terminal Blocks** are being generally adopted in railroad work.

Samples and particulars furnished promptly on request. 1

**EUREKA SUPPLY CO.** SEWELL, NEW JERSEY

## ALUMINUM

**Aluminum Company *of* America**
PITTSBURGH, PA.

**Electrical Conductors**
**Ingot Sheet Wire**
**Rod Tubing . . .**

Sales Offices:—
New York Cleveland
Boston Detroit
Chicago Philadelphia
Kansas City Rochester, N. Y.
Washington 3

## MICA

Any size, grade or quality, cut or uncut

## Mica Splittings

in medium, fine and superfine qualities.

D. JAROSLAW

19 Tower Hill, London, E. C. — Reichenbergerstrasse 79-80, Berlin So. 36
Cable Address: Splittings, London
Cable Address: Glimmerite, Berlin 3

## The American Brass Co.

**BENEDICT & BURNHAM BRANCH**
Successors to
**THE HOLMES, BOOTH & HAYDENS CO.**
**WATERBURY, CONN.**

Manufacturers of
**"K.K." Weatherproof Wire and Cable**
**Bare Copper Wire and Cable**
**Slow Burning Weatherproof Office Annunciator and Magnet Wire**

**NEW YORK OFFICE**
**99 John Street**

## CORDS WIRES

Show Window Cord — Lamp Cord
**Lowell Insulated Wire Co.**
Lowell, Mass.
Electric Light Wire — Telephone Wire

## ROME WIRE CO.
ROME, N. Y.

**RUBBER COVERED CODE WIRE**
TELEPHONE WIRE — MAGNET WIRE
BARE AND TINNED-COPPER WIRE

THE
**National Conduit & Cable Co.**
**Executive Offices: 41 PARK ROW, NEW YORK, N. Y.**

Bare Copper Wire and Cable
Weatherproof Wire and Cable
Office and Annunciator Wire and Cable
Paper Insulated Cable
Power, Telephone, Telegraph

**Boston** **Philadelphia** **Chicago** **San Francisco**

**MICA** FOR ELECTRICAL AND MECHANICAL PURPOSES

**INDIA—AMBER—DOMESTIC**

Any size, shape, pattern, grade, rough trimmed, rectangular cut, washers, discs, rings, cones, tubes, etc. For every use of mica we are prepared to submit samples and prices of qualities best suited to requirements. We can "show you." WRITE!

**EUGENE MUNSELL & CO.**
68 Church Street, NEW YORK
358 Dearborn Street, CHICAGO

**High Grade Resistance Metals**

**Wire, Sheets and Endless Tapes**

**"Excello" Resistance Metal**

Unequalled for use in the manufacturing of Electric Heating Devices. Can be operated continually at bright red heats without injury. Positively will not scale, rust or deteriorate. Specific resistance 550 ohms per mil foot. Melting point 3,000° F.

**"Ia Ia" Resistance Metal**

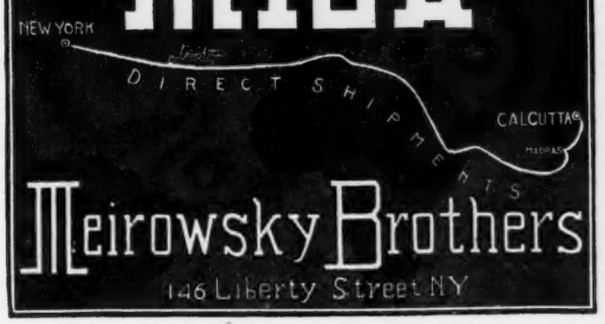
Specific Resistance 295 ohms per mil foot. Negligible temperature co-efficient. Non-corrosive. Best for Shunts, Measuring Instruments, Rheostats, Arc Lamps, etc.

**"Superior" Resistance Metal**

Specific Resistance 520 ohms per mil foot. Used in Heavy Duty Rheostats, Elevator Controllers, Arc Lamp Resistances.

**Hermann Boker & Co.**
**101-103 Duane Street, New York**

**MICA**




**Meirowsky Brothers**
146 Liberty Street NY

You'll be introduced to new wire economies when you become acquainted with the evenness, strength and GUARANTEE of

**Massachusetts MAGNET WIRE**
**Massachusetts Electric Mfg. Co.**
**WEST LYNN, MASS.**

TRADE MARK C-A WOOD PRESERVER REGISTERED U.S. PATENT OFFICE

**"C-A-WOOD-PRESERVER"**

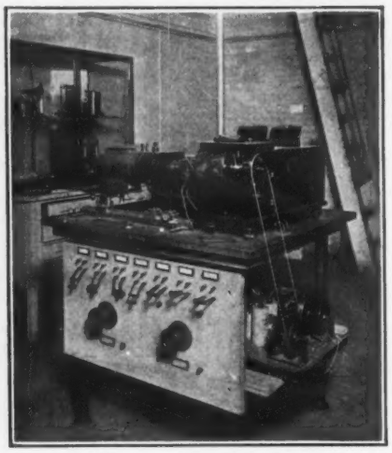
is the highest grade Carbolineum, Creosote or wood preserver produced. For information write

**C-A-WOOD-PRESERVER COMPANY**
56 Liberty St., New York
807 Wright Bldg., St. Louis

**PLATINUM**
IN ALL FORMS
FOR ALL PURPOSES
**SCRAP PURCHASED**
**THE ROESSLER & HASSLACHER CHEM. CO.**
N. Y. OFFICE 100 WILLIAM ST.
FACTORY PERTH AMBOY, N. J.

WRITE US WE MAKE LOW PRICES SHIP GOOD STOCK
**Idaho Red Cedar Poles**
31 CEDAR YARDS IN IDAHO, WASH. AND B.C.
**WESTERN LUMBER & POLE CO.**
Main Office: "Electric" Bldg., Denver, Colo.

# Wave Form Tests and Investigations



It is of importance to know the wave form of alternating current in many classes of work. This is particularly true where high voltages are used in the testing of insulations such as that on electrical apparatus, cables, etc.

We are prepared to make such tests either with the wave meter, where the wave is strictly periodic, or with an oscillograph where the phenomena is transient.

These tests may be made at any time, under any practical conditions and at any place.

We invite correspondence on the subject.

**Electrical Testing Laboratories**
**80th St. and East End Ave., New York**
4

# "Tophet" Resistance Wire

A non-corrosive, high-resistance alloy, particularly adapted for use in the construction of Electric Heating Devices or other Resistance Units worked continuously at high temperatures.

**Resistance per circ. Mil. Ft. at 75° F. is 600 Ohms.**

Write for sample and prices and ask also about "Raymur" and "Apex" Resistance Wires.

Murray Wire Co.
NEWARK, N. J.
1

HEMMING INSULATION
GUMMON
(EG)T
HEMIT

## STANDARD

Heat-Resisting Molded Insulation. Made by specialists exclusively devoted to solving your molding problems.

Why not profit by our experience

**HEMMING MANUFACTURING CO.**
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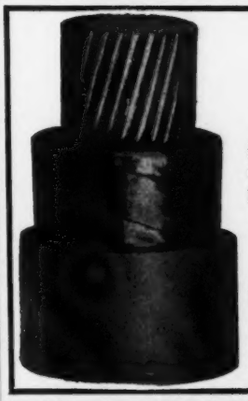

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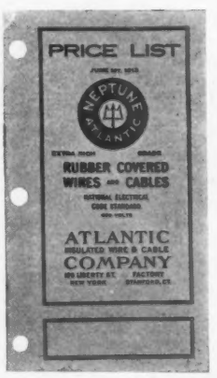


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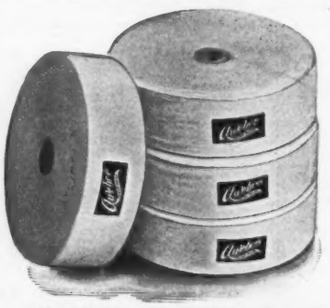

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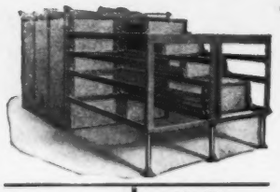

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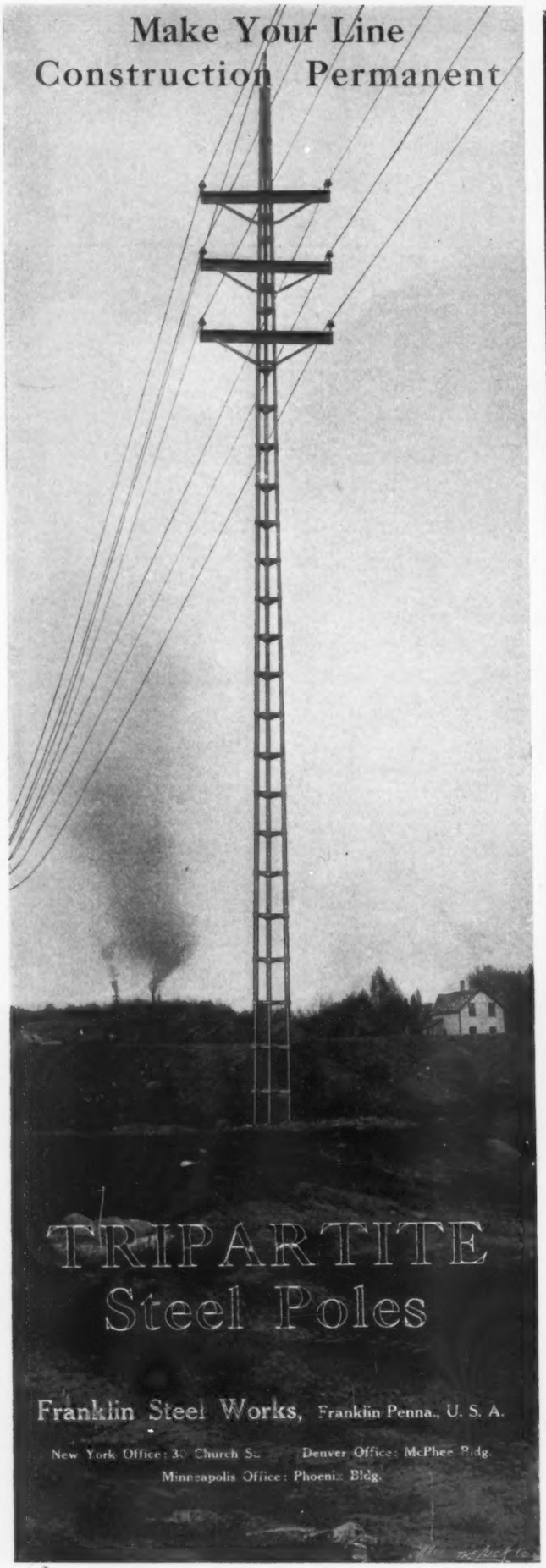
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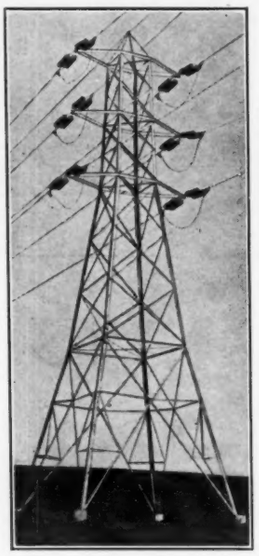

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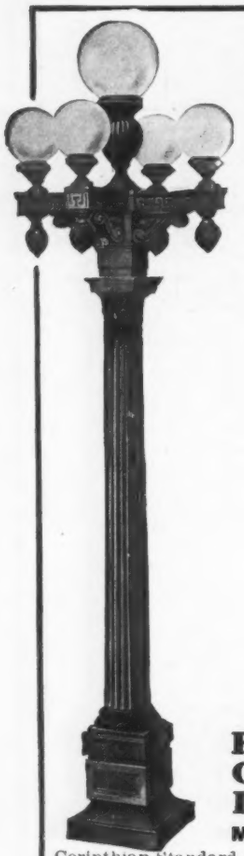

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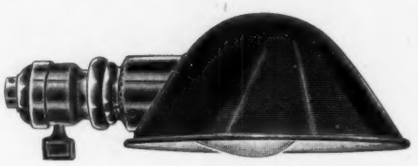

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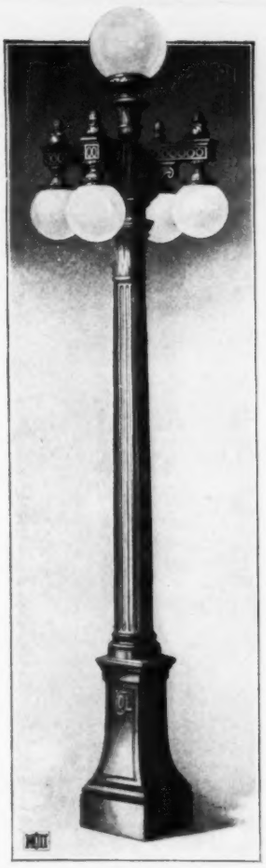

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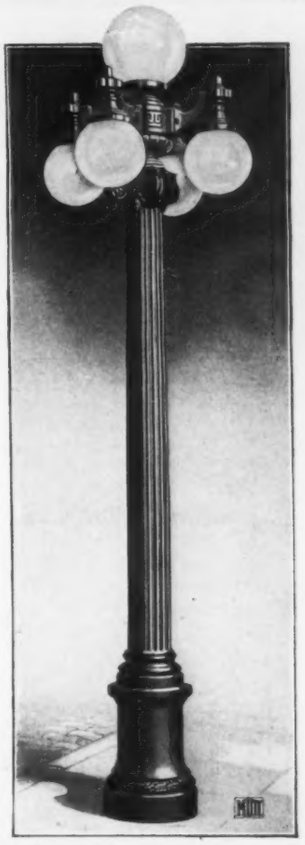

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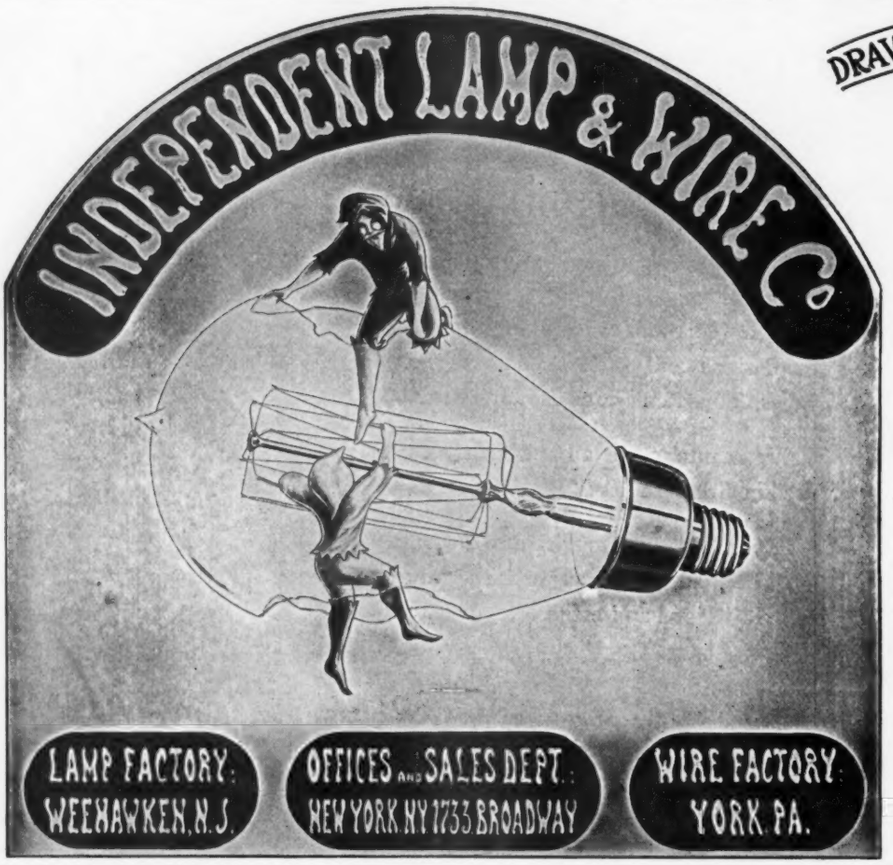
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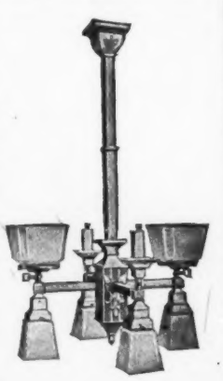

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And all this at

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Made in every variety for all types of arc lamps.

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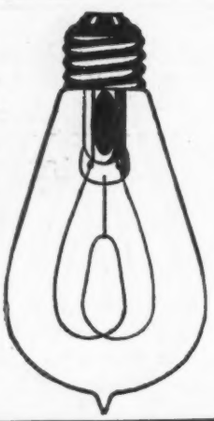

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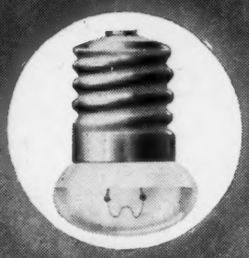

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## FLASHLIGHT LAMPS

## A Fact Worth Knowing

There is a wonderful demand for flashlight lamps. More of these are being sold to-day than large lamps of any one size. For this reason practically every electrical dealer's stock includes flashlight lamps.

Many dealers are giving their customers flashlight lamps of very poor quality, various makes of which are on the market. Are you one of these?

Here's the point to remember—"National Quality" superiority is not limited to large National MAZDA lamps. It applies to the entire product of National factories—to MAZDA flashlight, automobile and candelabra lamps.

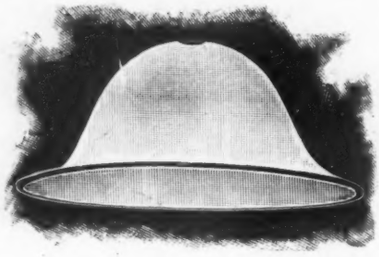
The unexcelled quality of National MAZDA flashlight lamps is a positive guarantee of maximum service from any flashlight in which they are used.

Build up your flashlight business on a quality basis. Give your customers the most durable and satisfactory lamps for their money. Start today by writing for our miniature lamp proposition.

**NATIONAL LAMP WORKS**
OF GENERAL ELECTRIC CO.
NELA PARK, Cleveland, Ohio

**Member Society for Electrical Development** **"Do It Electrically."**

# By Specifying "PRIMA"



## Enameled Steel Reflectors

Full benefit from every candlepower is assured. Made weather-proof, they cannot chip or crack, and their

## Efficiency is Guaranteed

Because of the lower duty under the Underwood Tariff, these superior imported reflectors are now meeting with much success in competition with domestic makes.

## "Lohys" English Steel Stampings

keep your core losses down to a guaranteed minimum when used for Rotors, Stators and Armatures.

**Write for Complete Technical Data and Prices**

## The Edward E. Cary Company, Inc.

**30 CHURCH STREET** **Hudson Terminal Building** **NEW YORK**

Sole Distributing Agents out of New York Stock for "Prima" Reflectors

**C. D. WOOD ELECTRIC COMPANY, 136 Liberty Street, New York**

IT MAKES THE FIXTURE ABSOLUTELY VERTICAL:

THE

## "Self-Adjusting Hickey"

makes it unnecessary for the wireman to use a plumb-line or to stand off and sight at the fixture.

Loosening the thumb-nut allows the fixture to swing by gravity to a vertical position—and a turn of the thumb-nut holds it there. Slide up the canopy and the job is done.

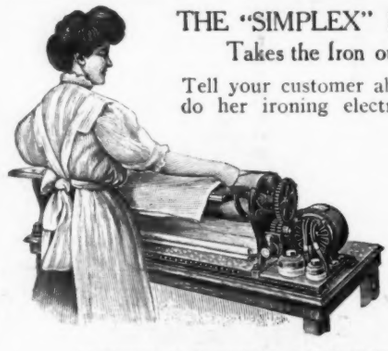
Prices and particulars are yours for a word. Write!

**ELECTRO DEVELOPMENT CO.**
416 Broadway, :: :: New York

## ASK FOR BULLETIN 77

and find out about this splendid machine. We make strong claims for this washer, but listen! We will ship it to any responsible dealer anywhere and permit him to examine it critically and subject it to exhaustive tests AND if he does not find it even better than represented he may return it at our expense. The **AUTOMATIC ELECTRIC WASHER** is making good in all parts of the world. It is bought by hundreds of dealers and central stations, and some of the biggest operating companies in the United States are supplying their stations with this machine because it gives the best satisfaction to their customers and the least trouble to their men. Profit and satisfaction go hand in hand where the **Automatic** is sold. Bulletin 77 tells you.

AUTOMATIC ELECTRIC WASHER CO., Newton, Iowa



THE "SIMPLEX" Household Ironer
Takes the Iron out of Ironing.

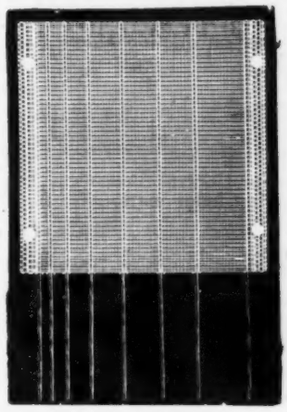
Tell your customer about it. Have her do her ironing electrically; no labor, little expense, in one-fourth the time. Our book of selling hints tells how to sell "Simplex" Ironers, and will help you sell anything. Write for it.

AMERICAN IRONING MACHINE COMPANY
Federal Life Building Chicago, Ill.

# Resistance Grids

SIMPLE, RELIABLE, LIGHT WEIGHT
and COMPACT

## Starts Your Motor Without Jerks



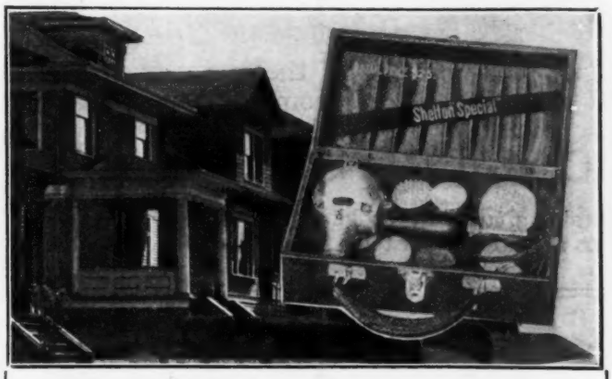
Suitable for
Motor Starters,
Meter Testing Apparatus,
Rheostats,
Controllers,
Testing,
Laboratory Work,
Heating Apparatus,
Load Resistance.

Valuable substitute for cast grids.

All sizes from .05 to 700 amps.

Easy and inexpensive to mount.
Cost less than lamps and do not break.
Complete catalogs and samples sent on request.

**Dubilier Electric Company, Inc.**
63 FIFTH AVENUE NEW YORK, N. Y.




## More Lighting Contracts

are secured when the Central Station makes a complete display of current-using devices. They weigh heavily in deciding whether or not a house shall be wired. Make

## THE SHELTON LINE

a part of your sales-building equipment. It includes Vibrators, Hair Dryers, Massage Apparatus, Drink Mixers and Vacuum Cleaners.

## Our Advertising Campaign is Creating a Demand

and our proposition is a liberal one, sure to take well in your territory. Ask for complete catalog and Central Station proposition.

**SHELTON ELECTRIC COMPANY,** New York, Chicago, Boston

2

# A Text Book For Gift Makers

is our new booklet "The Dainty Way to Keep House." We are sending it into thousands of homes all over the country, upon request.

## The Resultant Business

comes to you, and your responsibility in the matter is to **keep up your Simplex Stock,** and give inquiring customers **the goods they want.**

SIMPLEX ELECTRIC QUALITY

**Simplex Electric Heating Co.**

*Mfrs. of Everything for Electric Heating and Cooking.*

CAMBRIDGE, MASS.

**15 So. Desplaines St., Chicago, 612 Howard St., San Francisco, Calif. Belleville, Ont.**

# Royal Profits

The "Royal" line of Electric Suction Cleaners, Vibrators and Hair Dryers offers an exceptional opportunity to add a very profitable department to your business.
The high quality of "Royal" electric specialties is recognized everywhere. Design, workmanship and materials are the best and every machine carries our guarantee.
The demand for "Royal" machines is due entirely to their exceptional merit and the satisfaction they invariably give to the operator.

## Our Central Station Plan
### A "Day Load" Booster

We have evolved a plan for the sale of "Royal" machines especially for Central Stations. Our plan not only insures the profitable sale of electrical appliances, but helps materially in solving the problem of increasing your "day load."

## Our Co-operative Dealers Plan
### A Profit Accumulator

Every "Royal" dealer reaps the benefit of our constant advertising. Our plan of co-operating with our dealers insures the sale of "Royal" products and brings buyers of other articles to your store. A stock of "Royal" machines suitably displayed will increase your Christmas trade.

## "Do It Electrically—With a Royal"

Write now for catalog and particulars. Every delay keeps profits away.

**The P. A. GEIER COMPANY**
**5104 St. Clair Avenue, Cleveland, Ohio**

# Low Cost of Operation is one of the many features which recommend the Berkeley Automatic Electric Cooker

The intermittent use of current maintains a constant cooking temperature. Simple to operate. Requires no attention. Write us for details.

Berkeley Electric Cooker Co., 1932 Center Street, Berkeley, California

# Spot Cash

paid for

**Rubber Jars** **Worn Out Batteries**
**Battery Sediment** **Old Lead Plates**

Or any old apparatus and material used in battery plants. We buy and dismantle plants of any size and anywhere.
Write and tell us number of cells, number of plates in each cell, size of plates and we will make you a cash offer.

**National Metal & Rubber Co.**
**30-31 India Wharf** **BOSTON, MASS.**

# THE NUNGESSER LINE

**Amorphous Carbon Electrodes**
**Carbon Brushes**
**Graphite Brushes**
**Metal Brushes**
**Dry Cells**

From those who use any of the above and want the guaranteed best, we ask for an opportunity to quote.

**THE NUNGESSER CARBON & BATTERY CO.**
**3803 KING AVE., CLEVELAND, OHIO**

# The first gun has been fired!

Over 22,000,000 people are reading forcible publicity for the ELECTRIC VEHICLE in their favorite magazines. Surely some of these readers are right in your territory. Why not put your Central Station-your advertising-back of this Campaign?

*Boost the Electric Now*

The Electric Vehicle Association of America

Boston 124 W. 42nd St. New York Chicago

90

V. A. Gross

## PRICE OR MAINTENANCE — WHICH?

The Edison Storage Battery costs more to make and less to operate and maintain than any other storage battery. Is it cheaper in the end? YES, Edison Nickel-Iron Alkaline Batteries are an investment—not a running expense. The upkeep is negligible and no expert attention is necessary for their use. In other words,

## Edison Electric House Lighting Plants

are a **Sales Proposition, not a Repair Renewal Replacement** and **Maintenance Account** that vex the customer and reflect on the ability, integrity and intelligence of the Dealer or Contractor.

Guaranteed capacity for FOUR YEARS—Good for many more.

Write for our Proposition Covering **Complete** Plants.

**EDISON STORAGE BATTERY CO. - 145 Lakeside Ave., Orange, N. J.**

## FRICTION OR OIL— WHICH COSTS MOST?

Poor Oil Is Expensive. Good Equipment Deserves

## "Anti-Corrosive Cylinder Oil"

We will prove to you, by sending enough for a 60 day test, that "A.C.C." is the best and cheapest although not the lowest in FIRST COST.

If it fails to "show you" we will accept *your* basis of value in settlement.

"Heads you win, Tails we lose."

Send for one or more barrels to-day.

**E. H. KELLOGG & CO.**

**243-244 South St. NEW YORK**

*Established FIFTY-THREE years ago.* 3

## Ventilation Is Good for Motors

and that is why we have provided maximum cooling surface and free access of air to the windings of

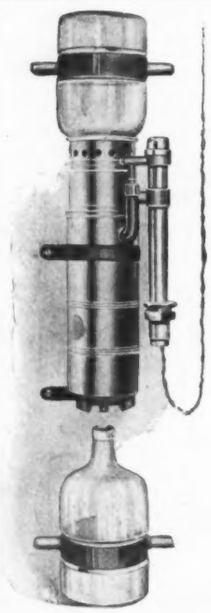
**ECK PROTECTED TYPE MOTORS**

After a 10-hour run at full load, temperature rise will not exceed 40 degrees C. above the surrounding air. Tell us your power requirements and we will quote on a motor that will meet them perfectly. Write for Bulletin No. 40

**ECK DYNAMO & MOTOR CO.**

**BELLEVILLE, N. J.**

6



## Safe Drinking Water Is A Vital Necessity

City water and "spring" water nearly always contain germs of water-borne diseases—but water sterilized by the

## Forbes Electric Heated Sterilizer

is perfectly free from germs. Anyone can operate it — and it produces water that is cold, sparkling and palatable; superior in every way to "spring" water or water sterilized by ordinary methods of boiling.

Ask for descriptive literature.

## Forbes Company

**1208 Callowhill St.**

**PHILADELPHIA, PA.**

**Representatives**

Westerberg & Williams, New York, Woolworth Building. Union Electric Company, Pittsburgh, Pa. Strong, Carlisle & Hammond Co., Cleveland, O. Jas. F. Forbes, No. 82 Union Ave., Montreal, Canada, Canadian General Distributor. L. Lumley & Co., Ltd., No. 1 America Square, Minories, London, E. C., Representatives for United Kingdom, English Colonies and Possessions, Continental Europe, Etc.

## Collets on Dies Are Unnecessary

for true clean thread cutting when

## Carpenter's Adjustable Dies

TRADE MARK C Registered

are used in **Carpenter's Adjustable Stock.** Standard for over 43 years.

*Ask for complete catalog.* 1

**The J. M. Carpenter Tap & Die Co., Pawtucket, R. I.**

## New 1914 Emerson Fans

**Catalog Now Ready Free To Dealers**

Emerson 1914 A.C. and D.C. fan motors show distinct improvements—features of interest to every one selling fans.

Full details in the new large catalog —just out.

*Write for it now!*

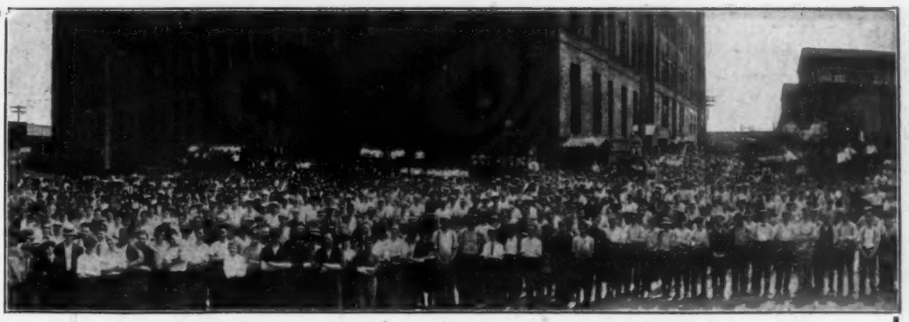
## The Emerson Electric Mfg. Co.

**2032 Washington Ave., St. Louis, Mo.**

**50 Church St., New York City**

## Noon Hour at the Factory

showing one of the buildings and a group of the day force of workmen.



# THE ELECTRIC STORAGE BATTERY CO.

New York Boston Chicago **PHILADELPHIA, PA.** Denver Portland, Ore. San Francisco
St. Louis Cleveland Atlanta **1888-1913** Seattle Detroit Los Angeles Toronto

## INTER-POLE MOTORS

Sparkless, even with a 100% momentary overload. Furnished for constant or adjustable speed.

A shift of the rheostat handle gives any speed, forward or reverse.

Write now for bulletins that fully explain exclusive, superior features.

**Electro Dynamic Co.**
BAYONNE, N. J.

Arcade Bldg., Philadelphia, Pa.; 200 Ninth St., Pittsburg; People's Gas Bldg., Chicago.

# DIXON'S GRAPHITE BRUSHES

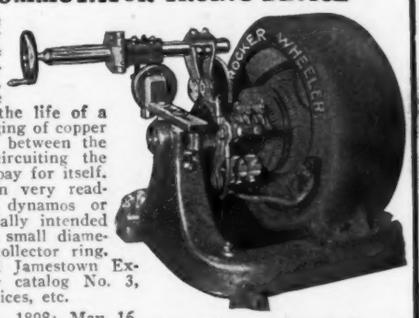
Combine the qualities of good conductivity and good lubrication, resulting in good operation of motor or generator with freedom from sparking. Ask for Booklet No. 47.

**Joseph Dixon Crucible Co.**
Jersey City New Jersey
3

## JORDAN COMMUTATOR TRUING DEVICE

This device will true your commutator without removing the armature; easy to attach and operate. Does not take large cuts, which shorten the life of a commutator; no dragging of copper across the insulation between the bars, thereby short-circuiting the same, and will soon pay for itself. This type device can very readily be attached to dynamos or motors and is especially intended for machines having small diameter commutator or collector ring. Silver Medal Award Jamestown Exposition. Write for catalog No. 3, with list of users, prices, etc.

Patented April 26, 1898; May 16, 1905; Sept. 6, 1910, and Jan 24, 1911. Other patents pending.




Front View of Type J Commutator Truing Device attached to Crocker-Wheeler Motor.

**JORDAN BROTHERS, Inc., 74 Beekman Street, N. Y. City**

Eliminate Wasted Time and Effort in Loading and Unloading by using
NATIONAL-CHAPMAN ELEVATING TRUCKS
Count Material Accurately and Quickly with a
NATIONAL COUNTING MACHINE
NATIONAL SCALE CO.,
432 E. West Street Chicopee Falls, Mass.
2

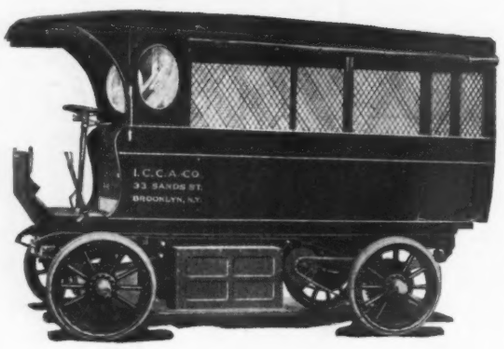
We have large facilities for
## METAL STAMPINGS
take contracts to manufacture complete metal specialties; make dies and tools of all kinds.
**NATIONAL STAMPING & ELECTRIC WORKS**
210-226 So. Clinton Street CHICAGO, ILLINOIS

**TROLLEYS**
**MARIS BROS.,**
**PHILADELPHIA**

CRANES HOISTS
**NORTHERN CRANES**
NORTHERN ENGINEERING WORKS
DETROIT, MICH., U.S.A.

# WILLARD STORAGE BATTERIES
**FOR ALL PURPOSES**
Manufactured by
The Willard Storage Battery Co.
Cleveland, Ohio

# Baker Electric Trucks




## *Superiority of Baker Axles*

**front and rear, over those commonly used in electric trucks, costs the owner a small difference in dollars and cents for a very great difference in the life and maintenance of the truck.**

### This Small Additional Cost

**buys extra toughness in the steel drop forgings; spring supports forged to the axle, not riveted or bolted; large spindles; Timken bearings; thrust bearings in front to make steering easy; hardened and ground pivots and steering connection pins; each a minor detail in itself, but taken altogether, a system of construction which will stand up under strain for ten years.**

**Any electric truck is cheaper to operate than horses or gasoline trucks for city work when new—the Baker truck while costing but little more than others is cheaper to operate its *entire life.***

***"Electric Trucks Last for Ten Years."***

**The Baker Motor Vehicle Co.**
**Cleveland**

Baker Electrics
QUALITY SERVICE

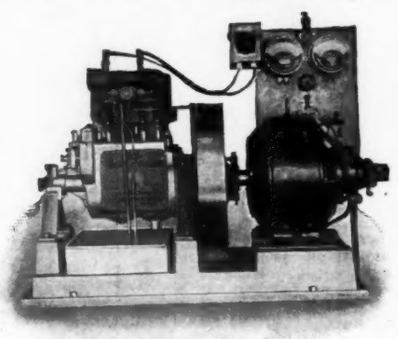
# Norma Ball Bearings

The extreme precision uniformly maintained in Norma Ball Bearings gives the freedom necessary to minimize friction without permitting the loose, chattering condition which is indicated by noise and which rapidly aggravates itself until failure results. The silent-running quality of Norma Bearings is an evidence of their anti-friction efficiency.

*Bulletin 102.*

## The Norma Company
**of America**
**22-26 Vesey St. New York**

# Brush Electric Lighting Sets



These plants are simple, reliable and economical; no expert attention is necessary.

For country residences, stores, moving picture shows, etc., etc.

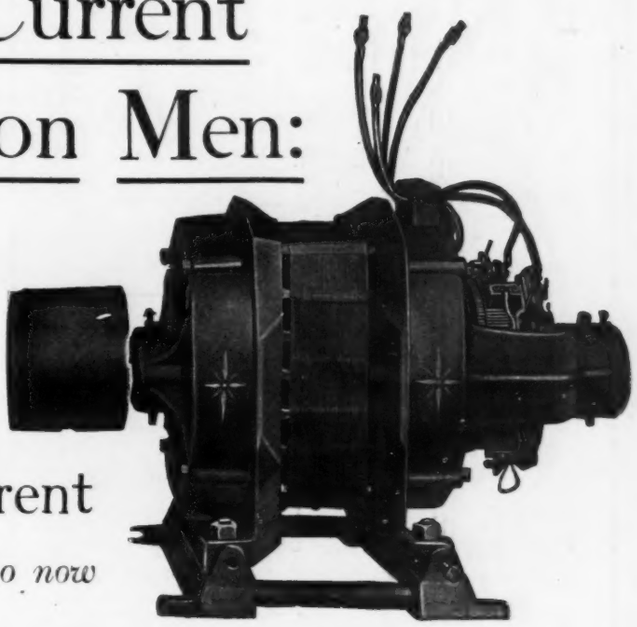
Made in sizes Two, Four and Ten Kilowatts. Compact, self-contained; regulation perfect.

Send for catalogue and trade prices.

**The Chas. A. Strelinger Co.**
**Box W-2 Detroit, Mich., U. S. A.**

KIMBLE MOTORS

# Alternating Current Central Station Men:



*We want to co-operate with you in the sale of*

1. Kimble Motors
2. Alternating Current

*to Printers in your district who now use other forms of power.*

## Why Do These Printers Not Use Alternating Current?

Average press speed is about 60% of maximum. Ordinary a-c motors consume as much power at 60% or any other fraction of maximum, as they do at maximum. Result, a waste of about 40% of the current for which the printer must pay. To use the alternating current and change it to direct current also entails a heavy loss of electricity and involves too great an initial investment for generating sets.

## Kimble Variable-Speed Motors Solve the Problem

Kimble single-phase, variable-speed, alternating-current motors with the unique Auto-Transformer Controller are built specially for printing press operation. They increase or decrease current consumption in direct proportion to every increase or decrease in press speed. They will operate a press smoothly at as low as 25% of maximum speed. They are cheaper in ultimate economy than any other form of power the printer can employ.

## Send Us the Names

Our efforts to sell our motors to printers are linked closely with your efforts to sell your power. The interesting and convincing data which we send to printers aids you greatly. Send us the names of printers in your vicinity who are not using your power, and let us show them why they are serving their own best interests in using Kimble Motors and alternating current to run their presses.

**Send for our Red Catalog.**

## Kimble Electric Company

**637 North Western Ave., Chicago**

KIMBLE MOTORS

# Peerless

## Let Us Take Care of the Little Ones

Be as particular, in your small motor selection as you are with its bigger brother. Don't let them lose their identity as motors just because they are small. Ten small motors running badly give you as much trouble in fuse blowing, repairs and complaints as ten large motors. We are past masters of small motor manufacture, from one to one-thirtieth horse.

Write us for prices on them and see how quality and price can walk side by side.

**The Peerless Electric Co.,** Warren, Ohio

Chicago Agency, 1536 Monadnock Bldg. New York Agency, 43 West 27th St.
Agents in All Principal Cities

# Motors



## Crocker-Wheeler Service

Neither begins nor ends with the sale of our machines. A careful investigation of your particular requirements precedes a complete estimate on the best possible installation. We see that you get the right apparatus and that it is properly installed. Then we stand behind that apparatus with an honest guarantee of satisfactory service. If quality and economy in operation interest you more than low first cost, we suggest that you get in touch with the nearest of the offices listed below.

**Crocker-Wheeler Company**
**Ampere, N. J.**

**Offices At**

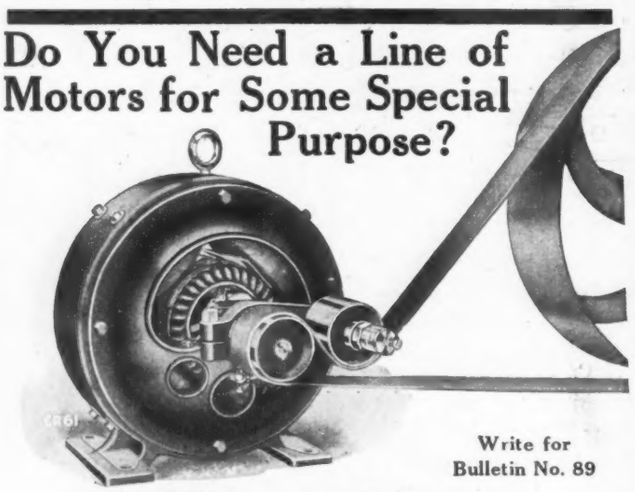
| | | |
|---|---|---|
| Ampere, N. J. | Cleveland | New Haven |
| Baltimore | Denver | New York |
| Birmingham | Detroit | Philadelphia |
| Boston | Houston | Pittsburg |
| Buffalo | Indianapolis | Salt Lake City |
| Chicago | Los Angeles | San Francisco |
| Cincinnati | Newark | Syracuse |

**Member of the Society for Electrical Development**

"DO IT ELECTRICALLY."



## Do You Need a Line of Motors for Some Special Purpose?



Write for Bulletin No. 89

# Robbins & Myers "STANDARD" Motors

We carry in stock constantly a most complete line of A.C. and D.C. Motors and are prepared to supply motors equipped as follows:

With Belt tightening idler pulley.
Without sliding base.
With back geared counter shaft.
With pedestal.
With automatic brake.
With reversible rotation.
With gauze enclosure.
With full (dust-proof) enclosure.
For mounting on side wall or ceiling.
From ¼ to 15 H.P.
Motor and Controller Outfits for sewing machine driving.

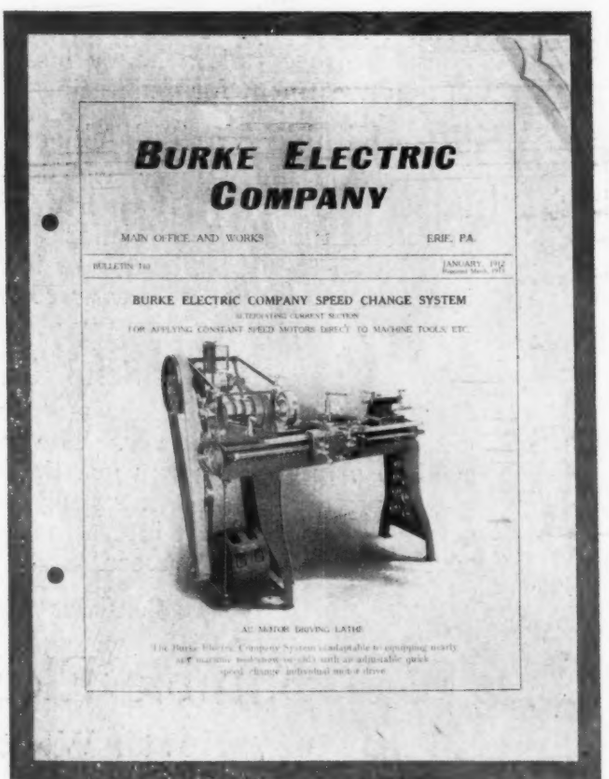
Our complete line of motors and generators comprises power motors up to and including 20 H.P. for direct current, up to and including ¾ H.P. for A.C. and polyphase motors up to 1 H.P.; also low volt and standard volt generators up to 15 K.W.

**THE ROBBINS & MYERS CO., Springfield, Ohio**

BRANCHES:—New York Chicago Boston Philadelphia St. Louis Rochester
Agencies in All Principal Cities

The "Standard" line of D.C. and A.C. Fans include every phase of desk, bracket, oscillating, ceiling, exhaust and ventilating requirements. Ask for booklets. 1




BURKE ELECTRIC COMPANY
MAIN OFFICE AND WORKS
ERIE, PA.
BULLETIN 710
JANUARY, 1912
BURKE ELECTRIC COMPANY SPEED CHANGE SYSTEM
FOR APPLYING CONSTANT SPEED MOTORS DIRECT TO MACHINE TOOLS ETC.
AC MOTOR DRIVING LATHE

THIS BULLETIN SHOWS HOW to apply motors to new or existing machine tools. Being, possibly, in your line of work, you should write for a free copy.

**BURKE ELECTRIC CO.,** Principal Office & Works ERIE, PA. 3

# How is the Voltage Out At the End of Your Line?

By means of the connecting board in the Wagner Central Station Transformer you can change the ratio of transformation, bring the secondary voltage up, and thereby make the lights bright without increasing your copper.

External appearance
of the smaller sizes of Wagner
Central-Station Transformers

# Transformer Voltage Taps

Wagner Central Station transformers are equipped with connecting boards within the case. It is a small matter to shift the links so as to obtain any of several ratios of transformation.

Each of the two primary coils has a tap brought out to the terminal board. It is possible to obtain three different ratios with primary coils in series and two ratios of transformation with primary coils in multiple.

In many cases this is of great convenience and usefulness, as it enables operation of transformers in different seasons at different ratios according to the demands upon that particular circuit. The loads of many circuits vary at different seasons.

Bulletin 904.

**Wagner Electric Manufacturing Company,**
**Saint Louis, Missouri**

Member of the Society for Electrical Development—Do it Electrically

Wagner Quality

2200

Speer Carbon Co.
ST. MARYS, PA.

**SPEER CARBON BRUSHES**

are now sold by our new system of predetermined characteristics, which makes it easy for you to pick out just the grade of brush to do best possible work under your own particular conditions.

No more feeling around in the dark, trying brush after brush till you happen to get one that gives fair service.

We believe you're entitled to the best—and we're ready to show you how to get it.

**Forget First Cost**

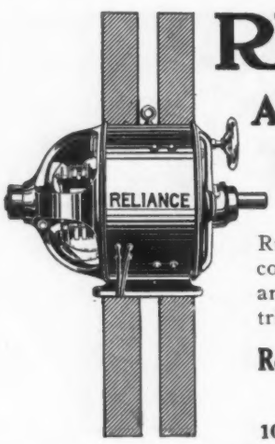
and fix your eye on operating cost, when buying brushes. Even though the first cost of

**"Le Carbone" Brushes**

is greater than that of other carbon brushes, the experience of hundreds of Central Stations proves them to be far more economical in the long run.

**W. J. JEANDRON, 174 Fulton Street, New York**

1




**RELIANCE ADJUSTABLE SPEED MOTORS**

Run at any speed and develop a constant horsepower output over any range up to 1 to 10. No electric controller used.

**Reliance Electric & Engineering Company**
1046 Ivanhoe Road Cleveland, O.

**SPARKING**

reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All of this may be avoided if you use

The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

**It will put that high gloss on the commutator you have so long sought after**

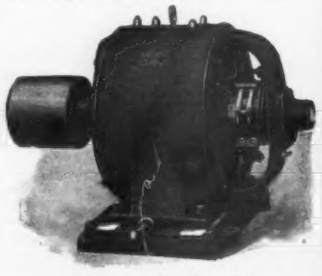
**Send for Stick 50c PER STICK $5.00 PER DOZ.**

For Sale by all Supply Houses, or **K. McLENNAN & CO.** Sole Manufacturers
**Room 411—130 Dearborn St., CHICAGO**

**Triumph** STEEL FRAME **Generators**

are sturdy, rugged, high-efficiency machines, designed and built to give dependable service under the most difficult conditions.

If this is the type of generator for which you are looking, you should write today for descriptive bulletin.



**The Triumph Electric Co.**
**Cincinnati, Ohio**
Branches in Principal Cities.

**COMMUTATOR INSURANCE**

THAT'S WHAT WE OFFER, FOR THERE'S NO FRICTION OR WEAR WITH THESE FIBRE GRAPHITE BRUSHES.

BEING 90 PER CENT. PURE GRAPHITE INSURES LOW RESISTANCE, NO SPARKING UNDER VARYING LOAD, LONGER WEAR AND NO GREASING.

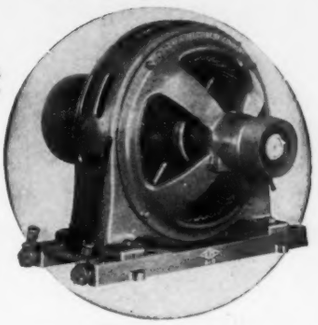
**HOLMES FIBRE-GRAPHITE Mfg. Co.**
GERMANTOWN, PHILADELPHIA, PA.

**Special**
**Blanking, Trimming, Piercing & Forming**
**DIE WORK**
**Solicited**
**The Columbus Die, Tool & Machine Company**
Columbus, Ohio

# ELECTRIC MACHINERY CO

MINNEAPOLIS E M MINNESOTA

## For the Small Plant Too



we have alternators which give just as dependable service as our big machines delivering thousands of Kilowatts.

The type shown here is built in sizes from 10 K.W. up to 200 K.W., and is belt-driven for power and lighting service in small Central Stations and industrial plants.

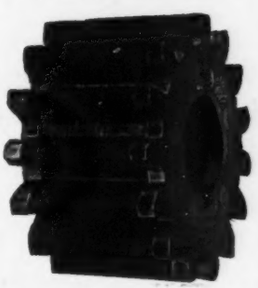
Tell us details regarding service and capacity required, and we will quote on a size and type of machine that will save money for you.

*Ask for Bulletins Describing Our Entire Line*

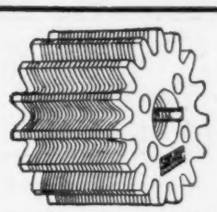
2

# Noiseless Pinions

For motor and other high speed drives. See our large advertisement in first and third issues of the month.



**New Process Gear Corporation 500 Plum St. Syracuse, N. Y.**



## A rawhide pinion costs more than a metal pinion, but—

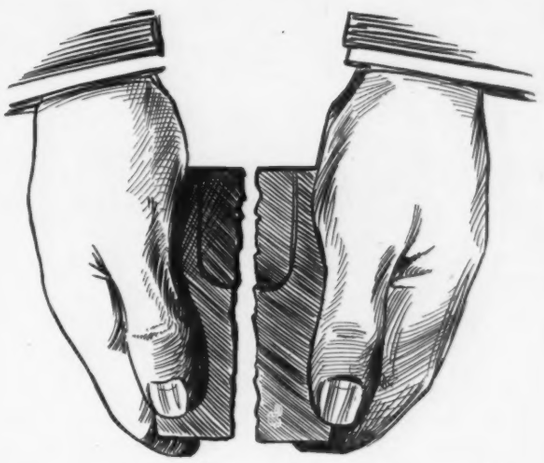
it is worth three or four of them when length of life is considered and it is tremendously more valuable when you consider that the rawhide pinion takes all the wear, thus prolonging the life of the metal gear, which is far more expensive.

**Chicago Rawhide Gears and Pinions**

in addition to effecting maintenance economies, eliminate noise, reduce friction and vibration and increase efficiency generally. Write for Booklet G.

**THE CHICAGO RAWHIDE MFG. CO.**
1303 Elston Ave., Chicago.

# If You Could Pull A Stackpole Brush Apart—Like This:



You could hardly tell it from any other—the *real* test is the service test. And even then you have all kinds of trouble unless you use a brush that's *suited to the service.*

## Brush Selection is Made Easy By The Stackpole Schedule

of brush qualities. It is a carefully compiled, reliable set of brush specifications, arranged in such form that you can put your finger on just the brush you need.

## Mail This Coupon

—whatever else you do today—tear it off and send it *now*. To do it means less commutation trouble and lower brush-cost.

**STACKPOLE CARBON CO.**

**St. Marys, Pa.**

**193 William Street, New York**

Stackpole Carbon Company, St. Marys, Pa.:
please send Stackpole schedule of Brush Qualities. I am interested in brushes for motors / generators } check here

Name .....

Address .....

Century

## Single Phase Motors

are especially valuable for

(½ H.P. Motor Geared to an Air Compressor for Garage Service.)

the operation of portable air compressors because they all have interchangeable voltage connections. (Standard 104/208 volts.)

Prompt shipments always from 26 branch stocks.

**CENTURY ELECTRIC COMPANY**

New York Office,
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Blaw

## Transmission Towers

## Steel Poles

Our splendidly equipped plant, combined with an organization of wide experience, permits us to make our proposals attractive and enables us to handle your work with accuracy and unusual promptness.

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General Offices:
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180 Foot Blaw Transmission Tower for River Crossing. Mississippi River Power Co.
Stone & Webster Engr. Corp.

## High-Grade Carbon Brushes

The heads of a thousand dynamo rooms state positively over official signatures that LE VALLEY VITAE CARBON BRUSHES

Actually save their first cost again and again;
Save time, labor and annoyance;
Save commutators, keeping them unscratched and glossy;
Save shut-down losses and repair bills;
Save and make reputations for men and machinery;

Are in fact the one absolutely proven, generally admitted high-grade Carbon Brush, worthy of complete dependence and exclusive use in all places under all circumstances.

**Le Valley Vitae Carbon Brush Co.**
**4123 Park Ave., New York City**
Catalogs and Testimonials on Application

## When Reactance Voltage Is High

and other influences prevent good commutation, use

## MORGANITE BRUSHES

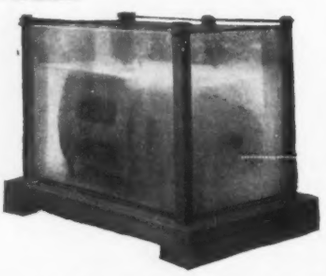
and stop the trouble. They have low contact-resistance on the edge where current enters, and high contact-resistance on the edge where it leaves, thus facilitating sparkless collection of current.

If you have brush troubles, send us data on your machine, and we will send you sample Morganite Brushes.

**THE MORGAN CRUCIBLE CO., LTD.**
**114 Liberty Street, New York City**
Factory; Brooklyn, N.Y.
Lewis-Roth Co., Denckla Bldg., Philadelphia, Pa.
INDIANAPOLIS BRASS CO., Indianapolis, Ind 1

## Lincoln Motors

impregnated with our special oil and waterproof varnish.



**Operate Under Water**
All windings both direct and alternating current are insulated in the same way.

**LINCOLN ELECTRIC COMPANY**
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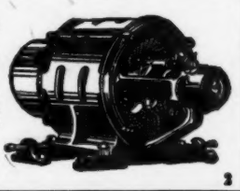
## HESS-BRIGHT BALL BEARINGS

FOR MOTORS REDUCE THE COST OF UP-KEEP

**THE HESS-BRIGHT MANUFACTURING COMPANY**
**37 East Erie Ave. Philadelphia, Pa.**

**The "Keep-A-Running" Qualities of Richmond Polyphase Motors**

make them the very best alternating-current motors on the market to-day. Bulletin No. 14 goes into detail—write for a copy.



**Richmond Electric Works**
Richmond, Virginia 3

# HAVE YOU EVER STOPPED TO CONSIDER

**SOME BELT DRIVES** are more efficient and wear better than others.

**THE PULLEY** on which the belt takes best "grip" is the pulley for lowest slip and maximum belt wear.

**HIGH BELT SLIP** is a direct loss of power. Furthermore it generates heat which dries out the belt, robbing it of strength and vitality. Such belts wear poorly.

**THERE IS ONE KIND OF PULLEY THAT INSURES LOWEST SLIP AND MAXIMUM BELT WEAR.**

## THE ROCKWOOD PAPER PULLEY

*"A PERFECT PULLEY FOR BELT DRIVES"*

**ITS SUPERIORITY** over other kinds of pulleys is real and the difference is worth while.

**BACK OF EVERY ROCKWOOD PAPER PULLEY** is over twenty-five years of continued satisfactory service.

**TO-DAY** it is the accepted standard for motor and generator belt drives.

**THINK IT OVER—THEN WRITE**—the proof is yours for the asking.

## THE ROCKWOOD MANUFACTURING COMPANY

**INDIANAPOLIS, INDIANA, U. S. A.**

# Is the Money Always There?

Your special training—or lack of it—hits you right in the money pocket. With everything but the salaries of untrained men going up, with competition becoming keener all the time, with the many wants that each day brings, and the time when there'll be nothing coming in—with all these conditions staring you in the face, you've got to decide mighty quick whether you're a success or not—and if not, how you can make friends with success and bid failure "good-by."

It's a serious proposition when you stop to think about it—this big spending and little earning. Yet, it needn't worry you one bit if you can increase your earning capacity far beyond your spending requirements. It's simply a matter of making your brain work instead of your body. Head work earns more than body work. You've got some good ideas—and you know it The International Correspondence Schools will help you turn those ideas into cash.

Select from the attached coupon the well-paid occupation you like best, mark the coupon as directed, and mail it today. That's all you have to do to learn how the I. C. S. can train you at home and in your spare time—no matter where you are, what you do, what your age. If you can only read and write, the way is open.

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| Electric Railways | Civil Engineer | Stenographer |
| Electrician | Stationary Engineer | Architecture |
| Telephone Expert | Gas Engineer | Contracting & B'ld'g |
| Concrete Construct'n | Refrigeration Eng. | Advertising Man |
| Mechanical Engineer | Sheet-Metal Drafts. | Window Trimming |
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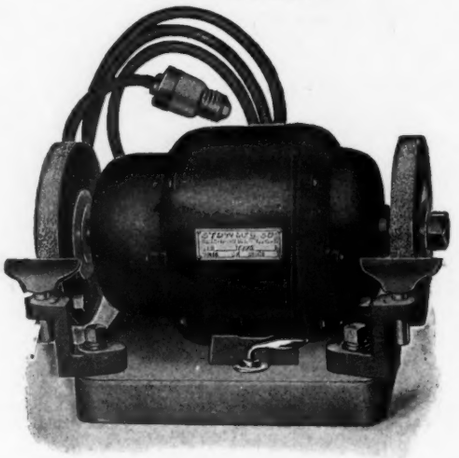
*Present Occupation* _____

# ELECTRIC BENCH GRINDER

**You will find it the handiest tool in your Shop!**



**We are now prepared to supply them as follows:**

No. 1, 1/6 H.P., A.C., capacity two 6 x ¾" Emery Wheels.
No. 2, ¼ H.P., A.C., capacity two 6 x 1" Emery Wheels.
No. 2, ¼ H.P., D.C., capacity two 6 x 1" Emery Wheels.
No. 3, ½ H.P., D.C., capacity two 8 x 1" Emery Wheels.
No. 4, 1 H.P., D.C., capacity two 10 x 1" Emery Wheels.

**STOW MFG. COMPANY**
**Binghamton, N. Y., U.S.A.**

*CHICAGO OFFICE:*
**BARTON TOOL AND SUPPLY CO, 106 So. Jefferson St.**
3

# Save the Heat

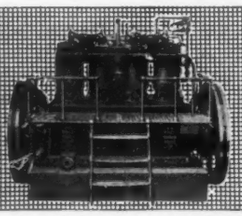
*in your Exhaust Steam by use of*
"MICHIGAN" Steam Pipe Casings

*for Insulating Underground Steam Heating Pipe,*

and turn it into revenue instead of letting it go to waste. Big Central Stations all over the country are doing this, and find Michigan Pipe Casings indispensable. Michigan Pipe Casing is absolutely waterproof—it is tin-lined to prevent radiation and is built of the most effective non-conducting materials. *A word from you will bring particulars and prices—write!*

**The Michigan Pipe Co.**
Bay City Mich.

*Also Manufacturers of MICHIGAN Combination Steel and Wood Water Pipe for Conveying Water in Connection with Hydroelectric Plants.*



**Bruce Macbeth Gas Engines**

*Send for catalog* 2122 Center St.,
The Bruce-Macbeth Engine Co., N.W., Cleveland

**VALVE and FITTINGS**
**All Sizes for all Purposes**
**Complete Piping Systems**

**PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.**
**PITTSBURGH, PA.**

# *Span the gap between your motor and your customer's machine with* MORSE Silent Chains

YOUR motor, the transmission system and the machine to be driven are equally important links in an imaginary chain.

You spend months, yes, years, developing different types of motors.

You investigate the service which the machine is to perform, then select the type of motor best suited for such service.

You know what your motor **should** do, and what the machine **should** do. But, will they do it? Much depends upon the transmission system.

By using MORSE Silent Chain Drives you insure two things:

**(1) Elimination of power losses in transmission.**

**(2) Smooth, uninterrupted motor operation.**

Your customer demands such apparatus as will insure full-capacity machine operation at all times.

You owe it to yourself to use that transmission which means longer life to your motors, and lower maintenance cost.

MORSE Silent Chains afford a flexible positive silent drive of practically 99% maintained efficiency.

Why couldn't we get together for our mutual benefit? Write our Engineering Department for particulars and copies of Chain and Sprocket Data Sheets, and Bulletin No. 11 descriptive of the chain and its application.

## Morse Chain Company, Ithaca, N. Y.

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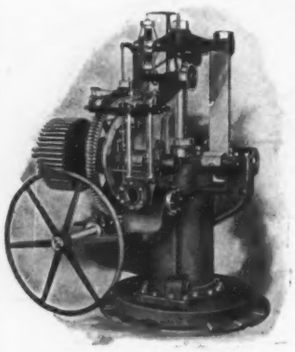


N. 14 Governor.
60,000 ft. lb. capacity.

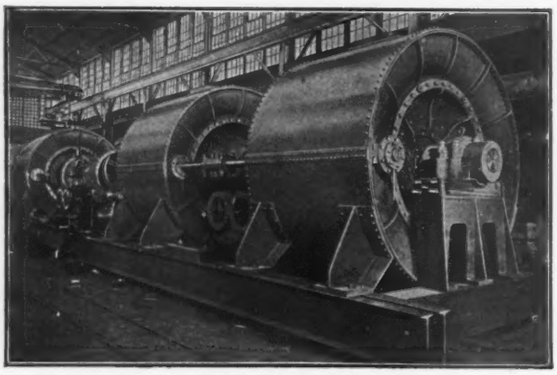
## FIRST OF ALL—RELIABILITY

The production of every one of our standard governors is the result of long continued, painstaking labor and conscientious care on the part of our employees. Our machines are governing many million horse-power of water wheels throughout the world.

*Write us if you have difficult problems to solve.*

**THE LOMBARD GOVERNOR CO.**
**ASHLAND, MASS.**

BRANCH OFFICES—504 Chandler Bldg., Atlanta, Ga. 1508 Fisher Bldg., Chicago, Ill.
Pacific Coast Agents—Pierson, Roeding & Co., 118 New Montgomery St., San Francisco.



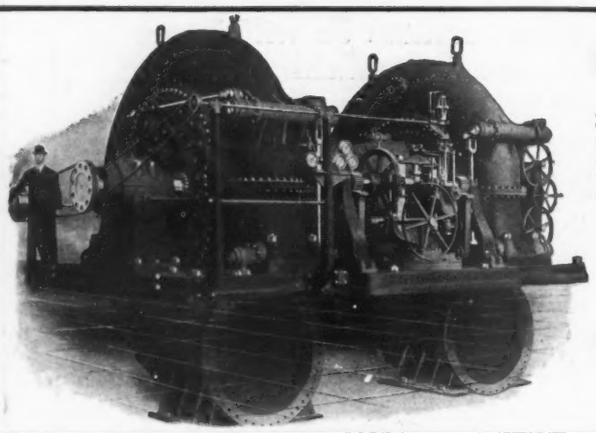
## SAMSON HYDRAULIC TURBINES

**16000 Horse Power**

Four of these units installed for the Madison River Power Company, Montana, operating under 110 ft. head, direct connected to 2400 K.W. generators. Total capacity 16,000 H.P. We build any design and capacity of turbines required. All of our work fully guaranteed in every detail. Let us send you our new illustrated catalog.

**JAMES LEFFEL & COMPANY**
**308 Lagonda Street, Springfield, Ohio**

1



## ONE OF SIX UNITS

7200 H.P. each, 225 R.P.M., 100 feet head. Built for the Great Falls Water Power and Townsite Co., Great Falls, Montana. These turbines when tested in place gave an efficiency of 88% at 7-10 and 8-10 gate opening.

**Turbines designed to meet all requirements for heads from 3 ft. to 650 ft.**

*Write us if interested.*

**S. MORGAN SMITH CO., - York, Pa.**

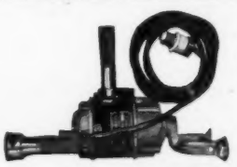
BRANCH OFFICES: 176 Federal St., Boston, Mass.
644 American Trust Bldg., Chicago, Ill.

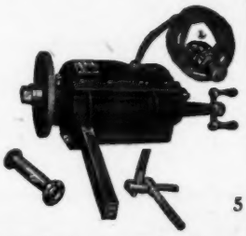
2

## Every Machine Shop and Garage Is A Profitable Prospect

for the Central Station man who will put a little time into selling

## U. S. ELECTRIC DRILLS AND GRINDERS



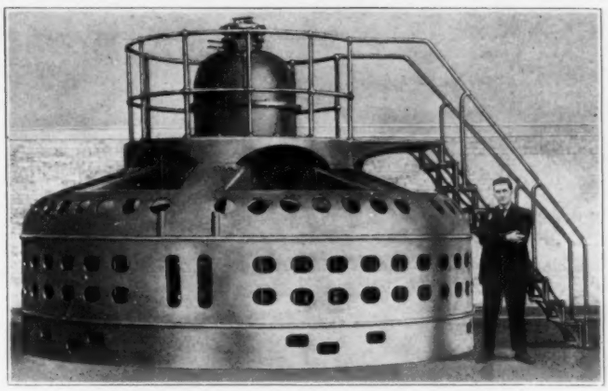


Drills for drilling metal, in sizes from ¼" to 1¼".
Centre Grinders for treeing lathe centres, sharpening cutters and dies or for general grinding on lathe, shaper or planer.
Bench Grinders for tool sharpening or general grinding or polishing. Made in six sizes, from ¼ H.P. to 5 H.P.
The first move toward "starting something" is to write for detailed information and prices. Do it now.

**The United States Electrical Tool Co.** Cincinnati, Ohio

New York Office, 50 Church St. Chicago Office, 8 E. Michigan St.
Boston Office, 12 Pearl St. St. Louis Office, Victoria Bldg.

5



2500 KVA, 164 RPM, with thrust bearing on top to carry combined weight of hydraulic runner and generator rotor.

One of the Many

## Vertical Water Wheel Driven Generators

Installed in the South

by the

ALLIS-CHALMERS MFG. COMPANY

Complete Hydro-Electric Power Plants including water wheels with governors, generators, exciters, transformers, switchboards, etc., all built by the Allis-Chalmers Manufacturing Company are operating all over the world with perfect satisfaction to the purchasers.

**Allis-Chalmers Manufacturing Co, Milwaukee, Wis.**

**OFFICES IN ALL PRINCIPAL CITIES**

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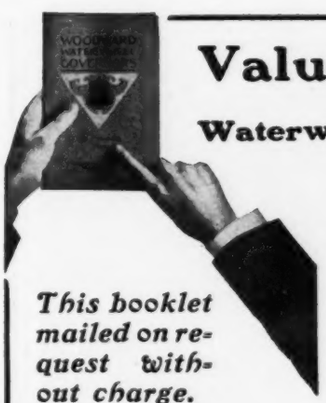


## Valuable Data ON Waterwheel Governor Construction

is contained in this booklet, a copy of which will be sent postpaid to any address on request.

***This booklet mailed on request without charge.***

**Woodward Governor Co.**
**202 Mill St., Rockford, Ill.**

## WATER WHEEL GOVERNORS

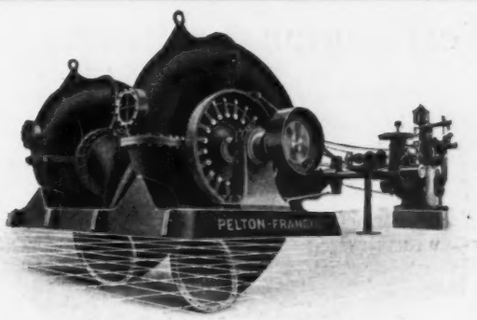
Reliable—on the job—every day and minute—because made right. Close regulation for wheels of every make and size—any kind of load—any head. Fully guaranteed.

**GOVERNOR DEPARTMENT, LUDLOW VALVE MANUFACTURING CO., Troy New York**

## TRUMP TURBINES

All styles and designs built to suit your location. Send at once for our illustrated catalog.

**THE TRUMP MFG. COMPANY**
**Columbia & Greenmount Aves., Springfield, Ohio**




The Ultimate Success of Hydraulic Developments depends on the choice of Water Wheel Equipment.

The engineer in charge can, and does, control every other feature of the work. His judgment and skill dominate each feature except the important one of wheel equipment.

Here we must rely on the skill, and experience of the builders' organization. The Pelton organization builds nothing but water wheels, has the experience of more than a third of a century, covering every country on the globe to guide it, and—more important—has a reputation to sustain.

Whether the ultimate size of the project is 100 H. P. or 100,000 horse power, Pelton Water Wheels—of the impulse or turbine type—assure satisfactory operation. Furthermore, an installation of similar size and general condition can be shown in operation.

**PELTON WATER WHEEL COMPANY**

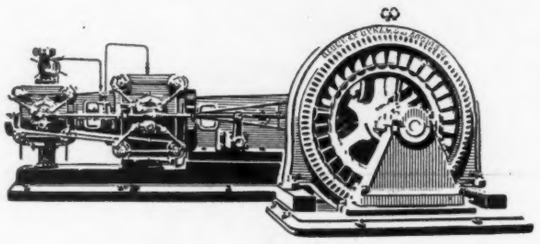
**91 West Street, New York**

**2231 Harrison Street, San Francisco, Cal.**

6

# Making Molehills Out of Mountains

No matter if your load-curve is humped like a camel's back—the heaviest, sharpest fluctuations will be met and carried with least speed-variation if your plant is equipped with



# Ridgway Units

Close regulation, one of the strongest of their distinctive features, is due to the highly-refined Ridgway governor which acts so promptly that speed seldom varies more than one per cent.

Moreover, every part is easily accessible for adjustment or repair, and steam and oil consumption have been cut to the limit.

Ask for the Ridgway Bulletins.

## RIDGWAY DYNAMO & ENGINE CO.

Ridgway, Pa.

## Worthington Condensing Apparatus

**The World Over**

All WORTHINGTON CONDENSING APPARATUS, whether of the SURFACE or JET type, is designed upon the counter-current principle, and is capable of maintaining in service the highest vacuum attainable with the quantity and temperature of water for which it is designed.

The success of this apparatus has been due to its careful development along scientific engineering lines, in many of which the WORTHINGTON COMPANY was the Pioneer. All of the details of design are carefully worked out with reference to durability as well as efficiency and absolute reliability in service.

The WORTHINGTON COMPANY will be pleased to furnish preliminary estimates, drawings and advice at all times.

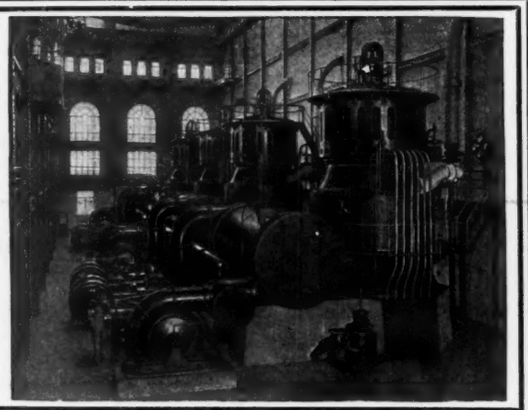
**Write For Bulletin W 177-38**

**HENRY R. WORTHINGTON**

**115 Broadway, New York** **Works: Harrison, N. J.**

**Branch Offices in All Large Cities**

W. 240.2



## McIntosh & Seymour Corporation

## DIESEL OIL ENGINES

AND

## STEAM ENGINES

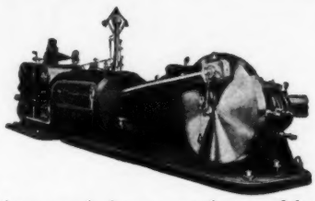
AUBURN, NEW YORK.

SOLE
AMERICAN LICENSEES
SWEDISH DIESEL ENGINE CO.

**New York Office, 50 Church Street.**

## MURRAY CORLISS ENGINES

**Engine on exhibition in theBourse, Philadelphia**



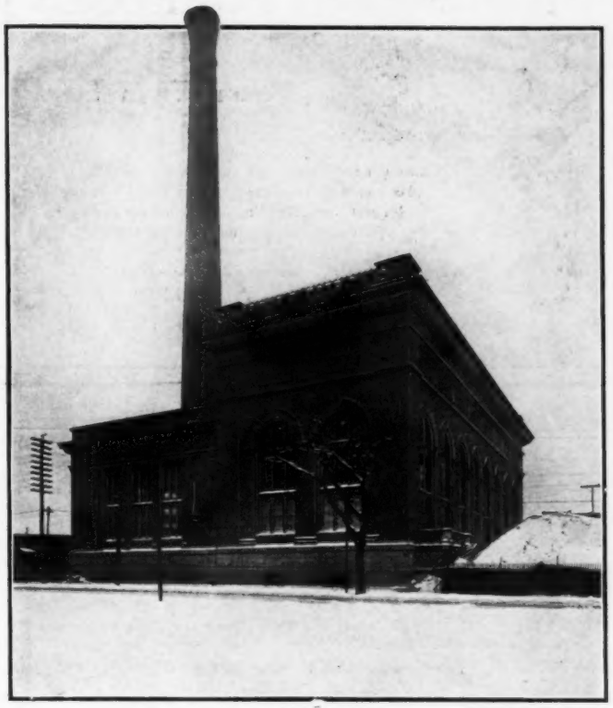
are of the latest design and best workmanship and excel in regulation, effiiciency and economy.

## MURRAY BOILERS

whether water-tube, tubular or marine, are always of the highest grade.

**MURRAY IRON WORKS CO. Burlington, Iowa**

Incorporated, Feb. 1st, 1870.



# Firemen On Strike!

## But It Didn't Matter, Because They Had

# The Taylor Stoker

**LATE one afternoon some time back—when the fires were low—the firemen at the above plant—Cambridge Electric Light—suddenly went on strike.**

**The dump plates were down. The strikers had hid the dump plate levers.**

**The night peak was coming on. What was to be done?**

**This is what WAS done:—**

**The Chief Engineer simply took several inside wire men from the store room, got dump plates up, and started the linemen shoveling coal into the hoppers.**

**The night peak (with the exception of the street lighting load, which was off just an hour) was carried with complete success.**

What would have happened if this plant had been hand-fired?

Every home and business place in the city would have been plunged in darkness.

It takes a skilled man to hand-fire a boiler. Any laborer can shovel coal into a coal hopper—and that's all the firing labor there is in a Taylor Stoker plant—and if it be equipped with suspended coal bin and chutes, even that labor is cut out.

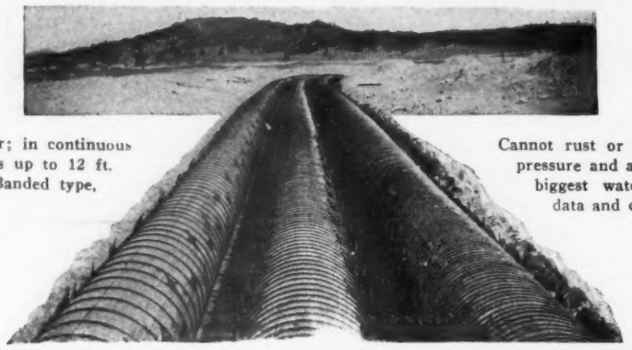
This Cambridge incident is evidence of what we mean by saying a Taylor plant is "an independent world unto itself"—immune to strikes and labor tie-ups.

**And that's one phase of the low TAYLOR operating cost—to be added to its low coal rate, low up-keep and "peak" ability. Don't you want details?**

## American Engineering Company, Philadelphia

## PORTLAND WOOD PIPE FOR PUMPING PURPOSES

**Equal to Cast Iron**



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Cannot rust or become incrusted. Stands high pressure and any temperature. Used in world's biggest water-works. Write for complete data and our unusually low prices.

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**P. O. Box 1183**

**Portland, Ore.**

3

## ATLAS OIL ENGINES—DIESEL TYPE

**Vertical, Four-Cycle** **300 to 1,000 B. H. P. Units**

The Diesel cycle without modifications,—enclosed in a simple, massive structure,—designed for continuous service,—as durable and dependable as the best steam plant.

Sold on the merits demonstrated in actual service.

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**Self-Dumping Underfeed**
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are spared the trouble, expense and injury to their boiler tubes coincident with mechanical cleaning, because *scale formation is prevented.*

Dearborn Treatment contains reagents for all the harmful elements in the water, and keeps the boilers in proper condition constantly, free from scale, corrosion, and pitting.

Send gallon sample of feed water for analysis and give the special treatment we would recommend a trial.

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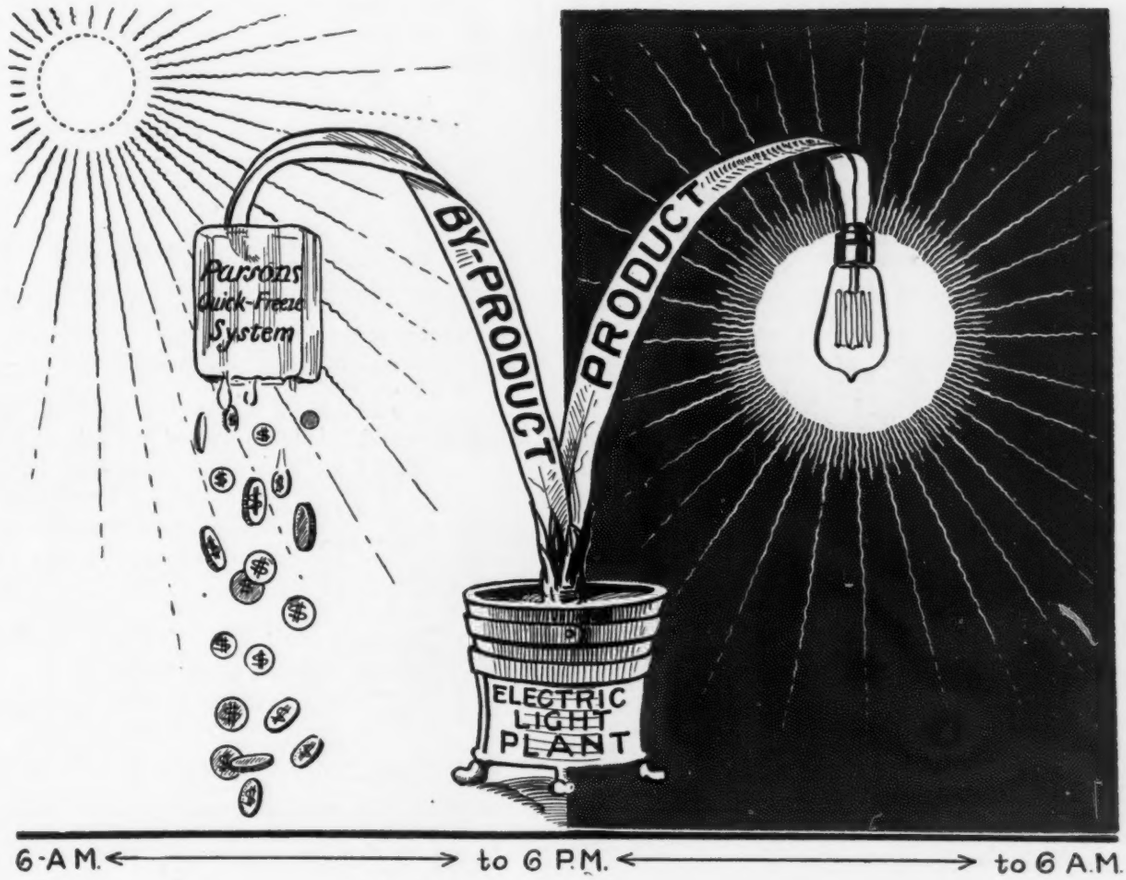
# Do You Know

that two blades of grass can be made to grow where one blade grows now? The way to do it is to utilize your "off-peak" power for ice-making, and yet have your full plant-capacity available for handling peaks by using the

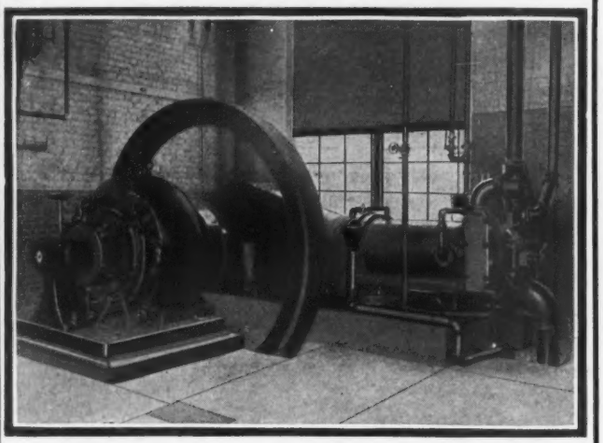
## Parson's "Quick Freeze" System




**Use Parson's "Quick Freeze" System and you can Harvest your Ice in 12 Hours**

# United Ice Improvement Co.

**Marbridge Building, Broadway and 34th Street, NEW YORK**



## Otto Electric Light Engines Regulate Very Closely

We guarantee that the regularity of the engine is such that the variation in voltage under changing loads from one-third load to full load, will not exceed 2 per cent.

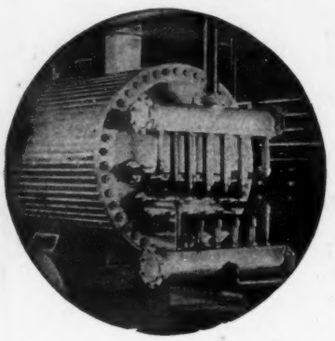
This is due to the unsurpassed Otto governor, correct design and heavy construction.

Bulletin No. 10 goes into detail—ask for a copy.

**The Otto Gas Engine Works**

3207 Walnut St., Philadelphia, Pa. 2

## Corner The Ice Market



You need practically no additional engine or boiler room labor, and no extra boiler capacity to operate a

## Carbondale Ice Machine

And for that reason you have a tremendous advantage over the ordinary ice-plant with its heavy operating expense.

For every H.P. of your engine capacity, you can make 600 lbs. of ice per day—and sell it at a figure that will give you a handsome profit.

Write for the Carbondale Booklet.

**Carbondale Machine Co.**

Carbondale, Pa.

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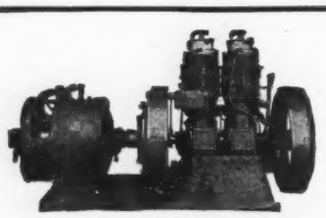

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## Oil Engines for Electric Light and Power

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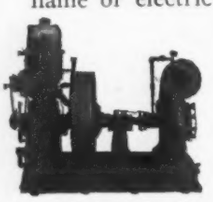

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Salesroom:
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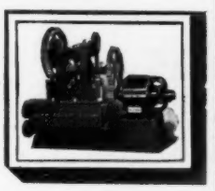
1

The

# DEMING

**Single Acting Triplex Plunger**

# PUMP



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All parts are well made, to wear long in use. The pump is economical of floor space and requires little attention during operation. For the house or the factory. All sizes, lifts and capacities. Write for prices.

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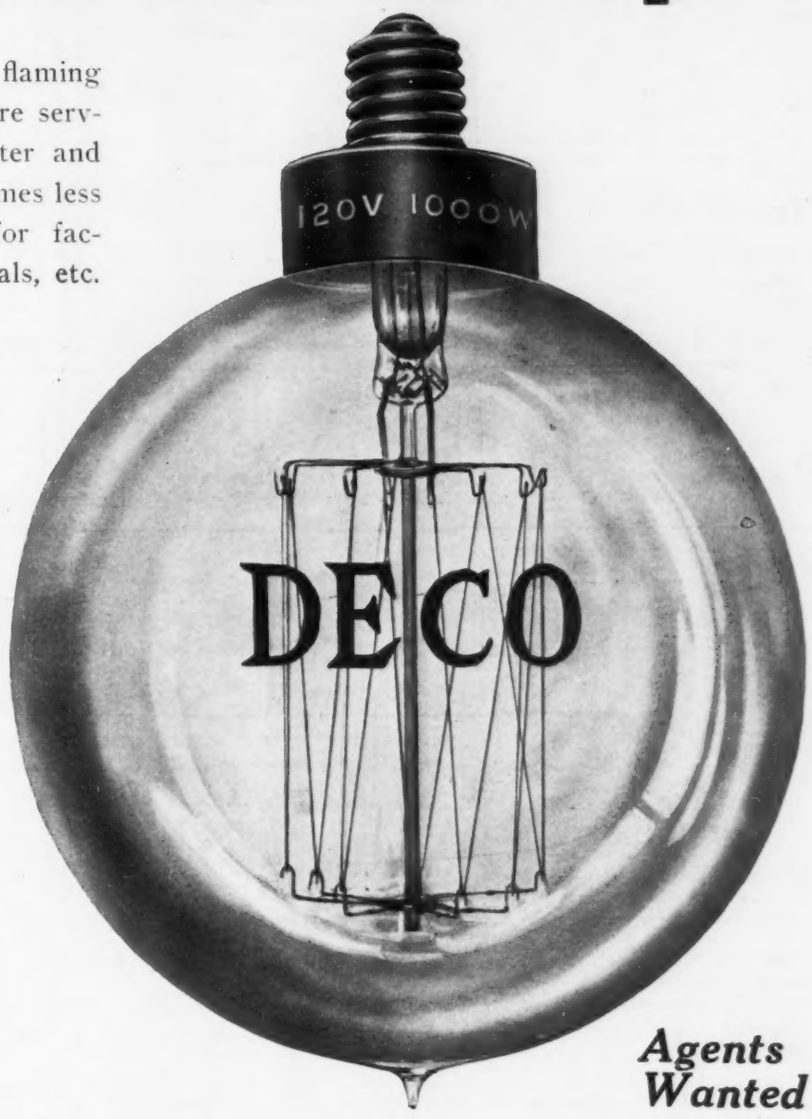


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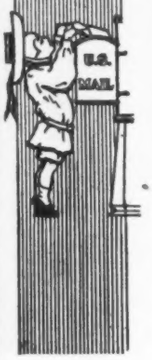


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| 1 | 50 Gen. Elec., ATB, form D, 220 or 440 volts, 3-phase | 1200 |
| 1 | 100 Ft. Wayne | 900 |
| 1 | 100 National, 3-phase, rev. field, 440 volts. | 900 |
| 1 | 100 Gen. Elec., 3-ph., rev. field, 220 or 440 volts | 900 |
| 2 | 120 Gen. Elec., type AS. | 900 |
| 1 | 125 Fairbanks - Morse, 3-phase, 220 volts.. | 900 |
| 1 | 150 Ft. Wayne, WAL.. | 450 |
| 1 | 180 Gen. Elec., type AS. | 600 |

#### 250-Volt D. C. Generators

| KW. | | Speed |
|---|---|---|
| 1 | 25 Western Elec. | 650 |
| 1 | 30 Allis-Chalmers | 1300 |
| 1 | 30 Browning | 1100 |
| 1 | 30 Sprague | 900 |
| 1 | 30 Commercial | 600 |
| 1 | 30 Browning | 600 |
| 1 | 33½ Jenney | 1175 |
| 1 | 35 Gen. Elec. | 1000 |
| 1 | 37½ Westinghouse | 400 |
| 1 | 40 Fairbanks-Morse... | 925 |
| 1 | 40 Western Elec. | 700 |
| 1 | 40 Northern | 650 |
| 2 | 40 Allis-Chalmers | 625 |
| 1 | 50 Ft. Wayne | 600 |
| 1 | 70 Gen. Elec., 3-wire, direct - connected, Shepherd cross compound engine | 300 |
| 2 | 75 Westinghouse engine type | 200 |
| 1 | 75 Westinghouse, direct - connected to Ideal engine | 250 |
| 1 | 100 Westinghouse | 700 |
| 1 | 100 Jeffrey, 6-pole | 480 |
| 1 | 100 Milwaukee, MP, direct - connected to 14 x 16 in. Buckeye engine | 250 |
| 1 | 100 Gen. Elec. CL6 | 600 |
| 1 | 110 Westinghouse, 6-pole, type M | 550 |
| 1 | 100 Westinghouse, MP, 3-wire, 125-250 volt, direct-connected to Watertown engine. | 260 |
| 1 | 150 Westinghouse, MP, 3-wire, 125-250 volt. | 580 |
| 1 | 150 Wiley direct con. to Atlas 4-valve engine | 225 |
| 1 | 200 Allis - Chalmers, 3-bearing | 300 |
| 1 | 240 Crocker - Wheeler, MP, direct-con. to cross-compound Vilter-Corliss condensing engine | 120 |

#### 125-Volt D. C. Generators

| KW. | | Speed |
|---|---|---|
| 1 | 10 Crocker - Wheeler, MP, direct-con. to Forbes vertical engine | 460 |
| 1 | 10 Gen. Elec., MP, direct-connected to 6 G. E. steam engine. | 450 |
| 1 | 11½ Westinghouse | 700 |
| 1 | 11½ Crocker-Wheeler... | 600 |
| 1 | 12 Northern | 700 |
| 1 | 12½ Gen. Elec. | 1350 |
| 1 | 15 Western Electric.. | 1000 |
| 1 | 15 Northern | 700 |
| 1 | 15 Westinghouse | 700 |
| 1 | 17 Westinghouse | 1125 |
| 3 | 18 Crocker-Wheeler... | 875 |
| 1 | 20 Northern | 1050 |
| 1 | 25 Sprague-Lundell .. | 850 |
| 2 | 25 Gen. Elec., Curtis turbine, 100 lbs. pressure | 3600 |
| 2 | 25 Gen. Elec., direct-connected to Westinghouse gasoline engines | 350 |
| 1 | 27½ Ft. Wayne | 700 |
| 1 | 30 Crocker-Wheeler... | 800 |
| 1 | 30 Gen. Elec. direct-connected to Gen. Elec. marine eng.. | 305 |
| 1 | 40 Sprague-Lundell .. | 725 |
| 1 | 45 Westinghouse | 850 |
| 1 | 47½ Westinghouse | 600 |
| 2 | 50 Triumph | 615 |
| 1 | 50 Westinghouse direct-con. to Harrisburg-Fleming eng.. | 300 |
| 1 | 50 Westinghouse direct-connected to Ideal engine | 280 |
| 1 | 55 Westinghouse | 800 |
| 1 | 60 Northern | 825 |
| 1 | 60 Thompson-Ryan | 600 |
| 1 | 60 C. & C., direct-con. to Ames engine | 275 |
| 1 | 62½ Westinghouse, direct-con. to Atlas 4-valve engine | 275 |
| 1 | 65 Gen. Elec. | 825 |
| 1 | 70 Ft. Wayne | 900 |
| 1 | 75 National | 750 |
| 1 | 75 Sprague-Lundell .. | 600 |
| 1 | 75 Northern, direct-nected to Racine comp. engine | 275 |
| 1 | 75 Westinghouse, direct-connected to Ames engine | 275 |
| 2 | 75 Westinghouse, direct - connected to Ideal engine | 275 |
| 1 | 80 Triumph | 750 |
| 1 | 100 Allis-Chalmers | 650 |
| 1 | 100 Milwaukee | 575 |
| 1 | 100 Triumph | 500 |
| 1 | 125 Milwaukee. | 450 |
| 1 | 125 Westinghouse | 700 |
| 4 | 150 Westinghouse | 475 |

#### 220-Volt D. C. Motors

Over 200 motors from ½ H.P. to 25 H.P. in stock

| HP. | | Speed |
|---|---|---|
| 2 | 25 West'n-Elec., comp. | 1000 |
| 1 | 25 Allis-Chalmers | 1000 |
| 1 | 25 Fairbanks-Morse... | 900 |
| 1 | 25 Fairbanks-Morse... | 800 |
| 1 | 25 New England | 750 |
| 1 | 35 Allis-Chalmers | 1175 |
| 1 | 35 Gen. Elec. | 975 |
| 1 | 35 Sprague | 800 |
| 2 | 35 Commercial, comp.. | 550 |
| 1 | 35 Browning, comp. | 500 |
| 1 | 40 Jenney, comp. | 1050 |
| 1 | 40 Gen. Elec., 6-pole.. | 915 |
| 1 | 40 Westinghouse, MP. | 350 |
| 1 | 50 Fairbanks-Morse .. | 825 |
| 1 | 50 Northern, MP, comp. | 800 |
| 1 | 50 Western Elec. | 600 |
| 1 | 50 Northern, MP, comp. | 580 |
| 2 | 50 Allis-Chalmers, MP. | 550 |
| 1 | 50 Westinghouse, MP. | 550 |
| 1 | 60 Ft. Wayne, 6-pole. | 575 |
| 1 | 60 Ft. Wayne, 6-pole. | 520 |
| 1 | 75 Milwaukee, MP... | 850 |
| 1 | 125 West'house, 6-pole. | 600 |
| 1 | 125 Jeffrey, 6-pole, comp. | 425 |

#### 500-Volt D. C. Motors

Over 100 motors from ½ H.P. to 25 H.P. in stock

| HP. | | Speed |
|---|---|---|
| 1 | 30 Gen. Elec., 6-pole, type CL. | 1025 |
| 1 | 30 Commercial, MP, comp. | 925 |
| 1 | 30 Willey, MP. | 900 |
| 2 | 30 Fairbanks - Morse, MP. | 900 |
| 2 | 30 Northern, MP. | 900 |
| 2 | 30 Westinghouse, MP, type M, comp. | 850 |
| 1 | 35 Allis-Chalmers, type KC, interpole, comp. | 825 |
| 1 | 35 Holtzer-Cabot, MP, comp. | 625 |
| 1 | 35 Gen. Elec., MP, form H. | 600 |
| 1 | 40 Allis-Chalmers, MP, type H. | 950 |
| 1 | 40 Commercial, MP, with extra armature. | 750 |
| 2 | 40 Northern, MP. | 650 |
| 1 | 45 Jenney, MP, comp. | 850 |
| 1 | 45 Westinghouse, MP, tvpe S, comp. | 750 |
| 1 | 50 Browning, MP. | 1050 |
| 1 | 50 Westinghouse, MP, type M. | 900 |
| 1 | 50 Commercial, MP... | 625 |
| 1 | 50 Triumph, MP. | 600 |
| 1 | 55 Fairbanks - Morse, MP. | 600 |
| 2 | 75 Westinghouse, MP, type S, comp., enclosed | 775 |

#### 3-Phase 60-Cycle Motors

Mostly 220 or 440-volt

| HP. | | Speed |
|---|---|---|
| 6 | 10 Wagner | 1140 |
| 2 | 10 Westinghouse, CCL. | 1120 |
| 1 | 15 Gen. Elec. | 1800 |
| 1 | 15 Richmond | 1200 |
| 6 | 15 Gen. Elec., form K. | 1200 |
| 2 | 15 Allis-Chalmers | 1130 |
| 1 | 15 Gen. Elec. (wound rotor). | 720 |
| 1 | 20 Gen. Elec. (wound rotor). | 1800 |
| 1 | 20 Westinghouse, CCL. | 1700 |
| 8 | 20 Gen. Elec., form K. | 1200 |
| 1 | 20 Gen. Elec., form L. | 1200 |
| 2 | 20 Westinghouse, CCL. | 1150 |
| 2 | 20 Wagner | 1140 |
| 1 | 20 Westinghouse, CX. | 1100 |
| 1 | 20 Gen. Elec., KT. | 900 |
| 2 | 20 Allis-Chalmers | 850 |
| 1 | 25 West'house, CCL. | 1700 |
| 2 | 25 Gen. Elec., K. | 1200 |
| 3 | 25 Gen. Elec., K. | 900 |
| 2 | 35 Western Elec. | 900 |
| 1 | 40 Fairbanks-Morse... | 1200 |
| 3 | 40 Westinghouse, CX.. | 850 |
| 1 | 40 Allis-Chalmers, direct - geared, Platt Triplex, pump. | 850 |
| 1 | 50 Allis-Chalmers | 850 |
| 12 | 50 Gen. Elec., K. | 514 |
| 1 | 60 Western Elec. | 720 |
| 1 | 75 Westinghouse, CCL. | 850 |
| 1 | 75 Gen. Elec., form K. | 720 |
| 2 | 100 Gen. Elec., form K. | 720 |
| 1 | 175 Gen. Elec., form K, 2200 v. | 600 |
| 2 | 250 Westinghouse, CX. | 580 |

#### 3-Phase 25-Cycle

| HP. | | Speed |
|---|---|---|
| 1 | 1½ Westinghouse, CK. | 710 |
| 1 | 3 Westinghouse, CCL. | 710 |
| 1 | 5 Westinghouse, CCL. | 1420 |
| 1 | 5 Westinghouse, CCL. | 710 |
| 2 | 7½ Westinghouse, CX. | 710 |
| 6 | 10 Fairbanks-Morse... | 750 |
| 1 | 10 Gen. Elec., form L. | 750 |
| 1 | 10 Westinghouse | 710 |
| 1 | 10 Westinghouse, CCL. | 710 |
| 1 | 15 Ideal | 1430 |
| 1 | 15 Gen. Elec., form L. | 750 |
| 1 | 20 Westinghouse, CCL. | 710 |
| 4 | 35 Fairbanks-Morse... | 750 |
| 1 | 40 Westinghouse, CCL. | 710 |
| 1 | 50 Gen. Elec., K. | 750 |
| 1 | 75 Fairbanks-Morse... | 750 |
| 1 | 300 Allis-Chalmers, 3-bearing, slip - ring type, 440 volt. | 480 |

**ALTERNATING CURRENT UNITS**

1—500 KW., General Electric Turbo, Generating Set, generator being type ATB, 4-500-1800 R.P.M., 3-phase, 60-cycle, 2300-600 volts, vertical type.

1—350 KVA., General Elec., rev. fld., 3-phase, 60-cycle, 600 or 2300 volts, 225 R.P.M., dt. ct. to 15 & 26x14 Tandem McIntosh & Seymour heavy duty engine.

1—300 KW., 25-cy., 3-ph., 440-v., West Elec., revolving field, 150 R.P.M., direct connected cross compound, Allis-Ch., type Corliss.

2—200 KW., Allis-Ch., 3-ph., 60-cy., 240/480/2300-v., revolving field alternators, 200 R.P.M., each direct connected, 19x18 Skinner horizontal automatic engine, practically new.

**BELTED ALTERNATORS**

3—350 KW., 3-ph., 60-cy., 2300-v., Stanley, 360 R.P.M., 3-bearing.
1—150 KW., Gen. Elec., 3-ph., 60-cycle, 480-240-volt, Form P, 600 R.P.M.
1—150 KW., Westinghouse, revolving field type, 3 phase, 60 cycle, 440 volt, 720 R.P.M.
1— 50 KW., General Electric, type ATB, form P., 3 phase, 60 cycle, 2300 volt, 1200 R.P.M.

**DIRECT CURRENT UNITS, 125 VOLTS**

1—200 KW., Gen. Elec., 125-v., with 15 and 26 x 17 tandem McIntosh engine.
1— 75 KW., Gen. Elec., horizontal turbo unit, 125-v., for 125 lbs.
2— 35 KW., Westgh., with 11 x 10 Ames engine.

**DIRECT CURRENT UNIT, 235 VOLTS**

1—200 KW. C. & C. 8 pole, 235 volt, compound wound, 200 R.P.M., direct connected to 18 x 17, Harrisburg 4 valve, side crank, horizontal engine.

**WATER TUBE BOILERS**

4—350 H.P. Franklin Heine type Water Tube Boilers, each containing 188 3½" tubes 18' long, and 2 drums 36" diam. by 21' long, ½" heads. These boilers have been recently inspected and allowed 160 lbs. working pressure. Price $1,400.00 each f.o.b. cars, without stack, flue or brick. Ready for loading.

**A. C. AND D. C. MOTORS**

All sizes and of every description.

**ARCHER & BALDWIN, 114-118 Liberty St.,** ROOM No. 302 Phone, Rector 4337-8-9 **New York**

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# MacGOVERN & COMPANY, Inc. 114 Liberty St., New York

**TURBO-GENERATOR UNIT—60 CYCLE**

1—500 K.W., Gen. Elec.-Curtis Turbo Generator, ATB, form T, 2 pole, 2300-volt, 157-amp., 3-phase, 60-cycle, 3600 RPM.

**DIRECT CONNECTED ALTERNATING CURRENT UNITS—60 CYCLE**

1—300 K.W., Westg., 60-cycle, 3-phase, 2300-volt, 60-pole, 120 RPM., rev. field, dir. conn. to Rice & Sargent, 14-in. & 28-in. x 42-in. horizontal cross compound, heavy duty engine.
1—360 K.W., Gen. Elec., 60-cy., 3-ph., 2300-volt, ATB, rev. fld., 150 RPM., dir. conn. to 24" x 27" horiz., side crank, right hand, heavy duty Buckeye engine.
1—300 KW., Crocker-Wheeler, 60-cy., 3-ph., 550, 440 or 220-volt, rev. fld., 150 RPM., dir. conn. to 14" & 28" x 30" Rice & Sargent, cross compound, heavy duty, Corliss engine.
1—125 K.W., Westg., 60-cycle, 3-phase, 2300-volt, rev. fld. 225 RPM., dir. conn. to 17-in. x 17½-in. Harrisburg-Fleming, 4-valve engine.

**BELTED ALTERNATING CURRENT DYNAMOS—60 CYCLE, 3 PHASE**

2—300 K.W., Westg., 2300-volt, rev. fld., 3 bearings, 514 RPM.
1—250 K.W., Bullock, 2200-volt, 12-pole, rev. fld., 600 RPM.
1—200 K.W., Westg., 2400-volt, rev. fld., 600 RPM.
1—150 K.W., Bullock, 2300-volt, 37.6 amp., rev. fld., 900 RPM.
1— 75 K.W., Gen. Elec., 240-volt, ATB., form P, 900 RPM.
1— 75 K.W., Gen. Elec., 240-volt, ATB-6, form PB, 1200 RPM.

**DIRECT CONNECTED DIRECT CURRENT—250 VOLT**

1—300 K.W., Gen. Elec., 250-volt, MP, 6-pole, comp. wound, 100 RPM., dir. conn. to 16-in. & 30-in. x 42-in. Hamilton-Corliss horiz. tandem, left hand engine.
2— 75 K.W., Crocker-Wheeler, CCD, 250-volt, 300 RPM., 275 RPM., each dir. conn. to one 14-in. x 14-in. Harrisburg-Fleming side crank engine.

**ROTARY CONVERTERS—60 CYCLE**

2—300 K.W., Westg., 12-pole, compound wound, 600 volts D.C., 385-volt A.C., 600 R.P.M., with [illegible] conn. induction motors, with transformers, 6600 or 2300 volts primary.
1—100 K.W., Gen. Elec., T.C., form A, class 6-100-1200 D.C., 550-volt, 182 amp., A.C., 340-volt, shunt wound.

The above are only a few items from our stock, as shown in November catalogue, just out.

## Duzets & Son

Hudson Terminal Bldg. New York

**Weekly Specials.**

350 H.P. Heine watertube boiler, 200 lb. pressure; 30 days service, cost $3,500, price.....$1,750
200 K.W. General Electric, type "ATB," 3 phase, 60 cycle, 2300 volt alternator with exciter.....$1,100
175 K.W. Allis Chalmers, rev. fld. 3 phase, 60 cycle, 2300 volt alternator with exciter and switchboard.....$1,050
Two 50 K.W. Warren 3 phase, 60 cycle, 2300 volt alternators with exciter and switchboards.....$350 each
85 K.W. Westinghouse, rev. fld. 2 or 3 phase, 60 cycle, 2300 volt alternator with exciter.....$500
Two 75 K.W. Crocker-Wheeler 250 volt direct current generators, direct connected Harrisburg engines with switchboards.$1,200 ea.
75 K.W. Westinghouse, 125 volt dir. current generator, direct connected Skinner latest type engine, 2 years old, with switchboard.....$1,200
25 K.W. General Electric, 125 volt dir. current generator, direct connected Erie Ball Engine.

**Send for complete "Bargain List"**

## Harold R. Wilson Machinery Co.

**ELECTRIC & STEAM MACHINERY SECOND HAND**
**New Bank of Commerce Bldg., ST. LOUIS, MO.**
**DIRECT CONNECTED A.C. UNITS (60 CYCLES)**

| K.W. | Make | Volts | Ph. | Engine Description |
|---|---|---|---|---|
| 1715 | G. E. Stanley | 2300 | 3 | to Green Hor. C. Comp. Cor. Eng. |
| 500 | G. E. | 2300 | 3 | to Curtiss Vertical Steam Turbine |
| 2—400 | Westge. | 440 | 3 | to Westge. Parsons Hor. Steam Turbine |
| 400 | G. E. | 2300 | 3 | to 18 & 36x42 Corliss Horizontal C.C. |
| 400 | National | 440 | 3 | to 24 & 48 Murray Corliss |
| 400 | Croc.-Wh. | 240 | 3 | to Rathbun Jones 4 Cylinder Gas |
| 3—375 | Ft. Wayne | 2300 | 3 | to 450 H.P. Diesel Oil Engine |
| 2—350 | West. Elec. | 2300 | 3 | to 500 Snow Gas |
| 300 | Westge. | 2300 | 3 | to Westge. Parsons Steam Turbine |
| 2—200 | Allis. Ch. | 2300-240 | 3 | to 19x18 Skinner |
| 160 | Stanley | Any | 3 | to 225 H.P. De Laval Hor. Steam Turb. |
| 135 | Westge. | 440 | 3 | to Westge. 3 Cylinder Vert. Gas |
| 110 | Bullock | 2200 | 2 | to 16x14 Ideal |
| 80 | Bullock | 2200 | 3 | to 14x14 Russell 4 Valve |
| 75 | G. E. | 2300 | 3 | to 150 H.P. De Laval Hor. Steam Turb. |
| 2— 75 | Westge. | 2200 | 2 | to 12 & 20x12 Westge. Vertical |
| 50 | Westge. | 2200 | 2 | to Erie Ball Simple Slide Valve |

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**Send for our latest complete list of Electric and Steam Apparatus.**

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50 K.W., 6 pole, C & C, 250 Volts complete.....$225.00
37½ K.W., type M, Westinghouse, 110 Volts.....$290.00
65 K.W., Crocker-Wheeler, 110 Volts.....$400.00
10 H.P., single-phase Wagner, B & A type.....$145.00
1 ton, 220 Volt Alfred Box Hoist, new.....$110.00
Large stock direct and alternating current motors, switchboards, etc.

**R. SCHEINERT CO.**
**125 North Third St., Philadelphia, Pa.**

**ENGINE GENERATOR SETS AND MOTOR DRIVEN PUMP**

General Electric, ATB, 100 KW, 900 RPM, 480 volt, 60 cycle, 3 phase belted generator with belted exciter and switchboard. Hardie & Tyres, 16 x 20, heavy duty balance valve, automatic engine, complete for belting to above generator.

James Clark, Jr., 40 KW, 250 volt, D. C. direct connected to Troy, 11 x 10, horizontal automatic engine.

"Brooks" two stage high pressure centrifugal pump, brass lined, with capacity 200 gal. per minute against 225 ft. head, direct connected to motor.

**V. M. NUSSBAUM & CO. Fort Wayne, Ind.**

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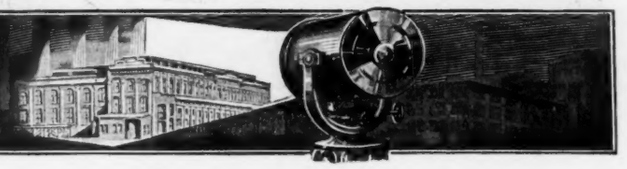

## In Actual Stock Ready For Immediate Delivery

**Direct Connected Revolving Field A.C. Sets, 3 Phase, 60 Cycles, 2300 Volts**

1—200 KW., 150 RPM., Allis-Chalmers to 16 x 36 Allis-Chalmers.
1—150 KW., 200 RPM., Westinghouse to 20 x 20 Erie Ball.
1—125 KW., 450 RPM., Westinghouse to Willans engine.

**250 Volts Direct Connected Engine Sets**

1—225 KW., 3 wire G. E. to 20 x 20 Erie Ball four valve.
1—160 KW., G. E. to 21 x 16 Ballwood.
1— 55 KW., C & C to 12 x 12 x 12 Harrisburg side crank.
1— 25 KW., G. E. to 9½ x 10 Erie Ball.

**125 Volts Direct Connected Engine Sets**

1—100 KW., Bullock to 14 x 12 Ball Wood side crank.
1— 75 KW., G. E. to 14 x 12 Ball Wood.
1— 50 KW., G. E. to 12 x 12 Ames.
1— 50 KW., Sprague to 13 x 14 Watertown.
1— 20 KW., Crocker-Wheeler to 10 x 10 Payne.
1— 6 KW., Engberg to vertical Engberg engine.
1— 5 KW., General Electric marine set.

**Belted Revolving Field Alternators, 60 Cycles, 3 Phase, 2300 Volts**

1—100 KW., General Electric ATB, Form P, 900 RPM.
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1— 30 KW., General Electric, Form P, 1200 RPM.
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1— 30 KW., Western Electric, 1200 RPM., 240 volts.
1— 15 KW., Westinghouse Revolving armature, 220 V., 1800 RPM., 1 phase.
1— 20 KW., C & C revolving armature, 220 V., 1800 RPM., 1 phase.

**Motor Generator**

1—110 HP., 220 V., Westinghouse D.C. motor to 1—75 KW., 125 volt generator.

**2300 Volt, 3 Phase, 60 Cycle, Induction Motors**

1—125 HP., Fort Wayne (G. E.) squirrel cage, 600 RPM.
1— 75 HP., Westinghouse, CCL, 850 RPM.
1— 50 HP., Westinghouse, CCL, 850 RPM.

**General Electric Automatic, 60 Cycle, Single Phase, Voltage Regulators**

10—6¼ KW., type RS, equipped with 2 or 3 phase motors.
25 Ampere, 10% buck and boost or 50 Amp. 5% buck and boost.
3—11¼ KW., type BR, belt driven 50 Amp. 10% buck and boost.
1—17½ KW., type BR, belt driven 75 Amp. 10% buck and boost.

**700 Motors and Generators in Stock all Voltages and Currents. Let us have your Requirements.**

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**143 N. 3rd St., PHILADELPHIA, PA.**

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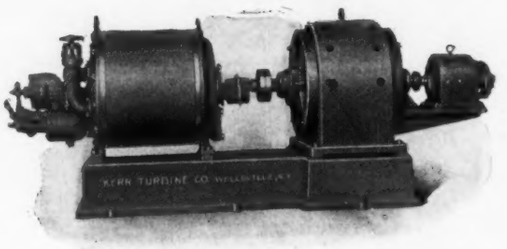

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Kerr turbine, non-condensing, form 186" M. with Burke generator, 50 KVA, 550 volts, 3 phase, 60 cycles, 3600 RPM and direct connected excitor. Base 78 x 38 x 43 inches high. Unit has never been used and is offered f.o.b. factory, Wellsville, N. Y.

### 25 KW Engine Generator Set

12 x 13, 270 RPM Armington & Sims engine, direct connected to and on the same base with General Electric Co. form F, 25 KW, 125 volt, D. C. generator No. 8147. Unit is in first class condition, has been superseded by central station supply, and is offered f.o.b. cars, Providence, R. I.

**Narragansett Electric Lighting Co.**
**Providence Rhode Island**

**COMMONWEALTH EDISON CO.**

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**FIRST-CLASS EQUIPMENT THROUGHOUT**

**DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, HIGH GRADE MACHINE WORK OF ALL KINDS.**

**CORRESPONDENCE SOLICITED**

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**R. M. ADAMS, Manager**

**Supplies Ozark, Altus and Denning with Electric Current**

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Electrical World,
New York, N. Y.

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Very truly yours,
R. M. ADAMS

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About 175 100-ampere and 210 200-ampere double-pole, single-throw, Knife Switches on slate bases. G.E. manufacture. Automobile manufacturer wishes to dispose of these at a low price on account of change in design. A quantity of **Wire Cleats** also for sale.

Box 1910, Electrical World.

## 500 KW MOTOR GENERATOR

3-phase, 60-cycle, 2300-480-volt, A.C. to 250-volt, D.C. machines. Either machine a motor or generator.

## 75 KW. BELTED ALTERNATOR

Fort Wayne, 3-phase, 60-cycle, 2300-volt, 900 R.P.M.

JAMES K. HOOPER, 5 Beekman Street, New York City.
Telephone Cortlandt 8251.

## FOR SALE

### Engine and Generator for Sale

17 K.W. Westinghouse, 3-wire D.C. generator, 110-220 volts, direct connected to Fairbanks 2-cylinder gas or gasoline engine, complete with switchboard, meters, etc. Having been used just six weeks. In good condition. Will sell cheap. Eugene I. Rosenfeld & Co., 8-10 S. Howard St., Baltimore, Md.

### Will Sell Cheap

50 K.W., 2-phase, A.Q.D. 60-cycles, 2300 volts, 1200 speed, equal to new—two 75 K.W., 115-volt General Electric form A generators—9½B brush arc generator. A. Werby & Co., 287 Atlantic Ave., Boston, Mass.

### Direct-Connected Bargains

100 K.W. Westinghouse single phase, 2300 volt, 60 cycle, to Ideal tandem compound engine, $1,250. Also 100 K.W. Westinghouse D.C., 575 volt, 8 pole, straight line engine, $1,000. Immediate delivery. Reco Company, 204 North 22d St., St. Louis, Mo.

### Machinery for Sale

Two G. E. 5-K.W. Generators, one 10-H.P. G. E. electric motor, one 7-H.P. Wood electric motor, one 3-H.P. Gregory electric motor, 6 copper bus bars, 26 ft. long; 7 copper bus bars, 15 ft. long; twenty 50-gallon stone jars, two laboratory rock crushers, two ball mills; material practically new. For further information apply or write Room 715, Putnam Bldg., Davenport, Iowa.

### Electric Light Plant for Sale

Direct current three-wire oil engine plant in fine town of Southern Michigan. Good street light contract and contract for pumping city water. Netted the owner for September $155; summer pumping will bring this above $200. Will sell for $6,000 on good terms. Address Glen Gardner, Stockbridge, Mich.

### Supply Business for Sale

Owing to ill health of one of the partners in an established and growing electrical supply business (no contracting), an opportunity is offered to purchase same. The business consists of large store and basement in the heart of New York City with complete stock and first-class fixtures. Must be sold before the first of the year. Box 1881, Elec. World.

### Direct Connected Unit For Sale

8.75-K. W. Westinghouse, 115-volt, Type S dynamo, connected to 5 x 5 self-oiling A. B. C. engine, $400.

**GEORGE BENDER**
**122 Center Street New York, N. Y.**

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### Recording Wattmeters Wanted

Wanted—Thomson commutator type recording wattmeters, 15-25-50 amperes, with high efficiency armatures. No objection if armatures are burned out. Box 1869, Elec. World.

### Oil Engine Wanted

Used oil engine, about 125 hp.; state make, mechanical condition, serial number and lowest cash price. Box 1857, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

## PROPOSALS

PROPOSALS FOR SWITCHBOARD, Electric, Cable, Conduit and Fittings and Miscellaneous Electrical Apparatus, Oil-burning Galvanizing Furnaces and Galvanizing Pots and Motor-driven Dry-kiln and Dry-room Equipment.—Sealed proposals will be received

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| 1-16 page, | $5.00 | 1 in. single col., | $3.00 |
| 1-8 page, | 10.00 | 4 in. single col., | 11.60 |
| 1-4 page, | 20.00 | 8 in. single col., | 22.40 |

*In replying to advertisements, send copies of testimonials, etc., instead of originals.*

## PROPOSALS

at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 A. M., January 10, 1914, at which time they will be opened in public, for furnishing the above-mentioned articles. Blanks and general information relating to this Circular (No. 815) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State Street, New York City; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.; also from the U. S. Engineer offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Commercial Club, Tacoma, Wash.—F. C. BOGGS, Major, Corps of Engineers, U. S. A., General Purchasing Officer.

TREASURY DEPARTMENT, SUPERVISING Architect's Office, Washington, D. C., December 4, 1913.—Sealed proposals will be received in this office until 3 P. M., January 5, 1914, and then opened, for a conduit and wiring system and lighting fixtures at the United States courthouse and post office, Texarkana, Ark., in accordance with drawings and specifications, copies of which may be had at this office or at the office of the custodian, Texarkana, Ark., in the discretion of the Supervising Architect. O. WENDEROTH, Supervising Architect.

## POSITIONS WANTED

AN AGGRESSIVE sales manager with a technical education and considerable practical business experience, would like to receive a proposition from a reliable manufacturer. References regarding ability, character and experience gladly furnished. Box 1885, Elec. World.

AN OPERATING engineer wishes a position as manager of a gas or electric light or combined property. Good construction and operating experience, technical graduate, a hustler for new business, can handle men, speaks some Spanish; reference if desired. Box 1868, Elec. World.

ASSISTANT general superintendent of a large electrical development in Ontario seeks change of position. Over 15 years' experience hydro- and steam-electric operation, construction and design. Good references Eastern and Western Canada. Position in commercial field preferable. For full particulars apply Box 1916, Elec. World.

ASSISTANT to executive, mining, milling or smelting plant, 26 years of age, single, broad-minded, well educated, organizing industrial efficiency and executive ability. Experience in wholesale hardware business, highest business references—willing to learn fundamentals of new business with unlimited future. Box 1898, Elec. World.

## POSITIONS WANTED

AUDITOR, experienced and expert accountant with high qualifications in electric utility accounting. Advertiser's experience has been obtained from the best utilities. Can install thoroughly up-to-date and practical accounting system. Quick and accurate, financial reports; costing. Bond furnished. High references, first-class character. Box 1919, Elec. World.

CONSTRUCTION ENGINEER with twenty years' experience specializing on transmission line and sub-station design and construction seeks temporary or permanent engagement. Best of references. Box 1913, Elec. World.

CORRESPONDENT, salesman, mechanical and electrical engineer, technical graduate, eight years' experience, desires position January 1. Address Box 1890, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

DEVELOPMENT WORK.—Graduate engineer, thorough technical and post-graduate scientific training, at present employed very successfully in development work of original apparatus and processes of great commercial possibilities, desires change for good reasons and would consider taking charge of similar work in mechanical or electrical line where producing results will meet with appreciation and advancement. References. Box 1900, Elec. World.

ELECTRICAL and mechanical engineer, 10 years' responsible experience with manufacturing; specialty small motors of every description, familiar with automobile lighting and starting. Member of A. I. E. E. Box 1875, Elec. World.

ELECTRICAL ENGINEER, technical graduate, desires position as superintendent of electric plant or some regular line of electrical work. Four years' experience and best references. Box 1918, Elec. World.

ELECTRICAL ENGINEER—Position wanted as chief electrician of manufacturing plant or superintendent lighting plant or electric railway. Small town in Wisconsin or the Middle West preferred. Salary, $125. 8 years' experience in all branches. Technical education. Box 1895, Elec. World.

ELECTRICAL ENGINEER, 30; European academic and American technical school training with brains and energy to invest, desires position with consulting, contracting, or manufacturing engineers. Several years' experience in engineering work, including electric traction. Inventive ability. Will make liberal arrangements with inventions now pending. Box 1749, Elec. World.

ELECTRICAL ENGINEER, 3 years' experience consisting in construction, testing, calculating, layout work, 2 years with General Electric Company, wishes position with chances for advancement. Box 1911, Elec. World.

ELECTRICIAN.—Position wanted by experienced electrician and engineer as superintendent or manager of an electric light plant, age 33, married, 13 years' practical experience. Now hold position as superintendent of a small plant and wish for advancement. Can handle A.C. or D.C. apparatus. Will furnish reference. Box 1903, Elec. World.

ENGINEER; graduate electrical engineer; 12 years in electrical work; would like position as sales engineer for electrical company, preferably in New York or vicinity. Age 27; best of references. Box 1904, Elec. World.

ENGINEER for Europe with ten years' European technical and commercial practice, university graduate, with perfect knowledge of French, German and Russian, would enter a first-class American firm to represent it later in Europe; has traveled extensively in Europe; can give bank references. Box 1902, Elec. World.

# SEARCHLIGHT SECTION

## POSITIONS WANTED

EXECUTIVE, or similar, position wanted by technically educated man having twenty years' experience, including drafting, designing, operating, construction, consulting work, and in executive positions. Last six and half years with one of the largest corporations in general engineering and construction business. Has had general charge of purchasing, auditing, and cost keeping departments, handling expenditures of upward of three million dollars annually, and expert in these lines. Excellent references. Box 1917, Elec. World.

EXECUTIVE position, or subordinate position ultimately leading to executive position, wanted in a large or small concern by man with technical education and head of company now doing $250,000 worth of business a year developed by him. Ten years' experience assuming large responsibility in handling men and money; tactful, resourceful, progressive and systematic, with good judgment. Willing to locate anywhere. Box 1756, Elec. World.

GRADUATE electrical engineer with five years' manufacturing and engineering experience desires executive position with manufacturing or operating company. Reasonable salary. Available January 1st. Box 1877, Elec. World.

MODERATE salary secures the services of technically trained electrical engineer with several years' engineering and factory experience. Position must offer good opportunities for advancement. Box 1880, Elec. World.

OPERATING MANAGER with large experience in hydraulic, steam and transmission work desires connection where broad experience and mature judgement will be appreciated. Familiar with all branches of central station management. Box 1914, Elec. World.

POSITION WANTED as chief operator or other responsible position in some hydro-electric station. Thoroughly experienced in high voltage station operating and repairs. Box 1853, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

POSITION WANTED by man who has and is making good as superintendent and manager of well-known concern; good mechanic and executive. Box 1848, Elec. World.

STORAGE battery inventor and expert in Germany, France and England, with 16 years' long experience in every kind of batteries, wants leading position or undertaking of factory building. Harry Bessemer, 10 Wilkins St., Detroit, Michigan.

SUPERINTENDENT—Position as superintendent of construction on steel tower transmission lines. Experienced in running camps and handling men in rough country. Permanent connection desired. Box 1894, Elec. World.

SUPERINTENDENT or manager. Three years' operating 10,000 KW. A.C. and D.C. line experience. High school and technical graduate. Twenty-five, married, references. $100. Box 1794, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

WORKING LINE foreman, married, strictly sober, understands standard line construction and maintenance, inside wiring, meter reading desires permanent position only. Small town preferred. Best of references. Box 1882, Elec. World.

YOUNG electrical engineer desires position with consulting or operating concern. Four years' experience with inspection bureau, manufacturing and operating companies. Specialty power and railway. Box 1879, Elec. World.

YOUNG MAN, electrical engineer, graduated in Germany, wishes a position in any line of work in Greater New York. Box 1899, Elec. World.

## POSITIONS VACANT

ELECTRICAL CONTRACTORS require thoroughly competent estimator. Give age, full particulars of experience, previous employment and salary expected. Box 1915, Elec. World.

ELECTRICAL ENGINEER WANTED.—An inventor wishes the assistance of an electrical engineer thoroughly familiar with the theoretical and practical ends of the manufacturing telephone apparatus, particularly receivers and transmitters. Promising opportunity for the right man. State at once experience and salary expected. Box 1961, Elec. World.

LINEMAN FOREMAN wanted, energetic young man competent to handle line work, trouble on transmission line, arc lamp department, etc. Town of 15,000 in Iowa. Salary $70 to $80 per month to start. Box 1866, Elec. World.

MANAGER for electric traction and lighting company in West Indies, serving 70,000 population. Must know Spanish. Give full particulars of experience and previous employment. Box 1822, Elec. World.

MOTOR MAN.—Wanted, experienced all-around motor man on a.c. and d.c. machines. State salary, where employed. Box 1867, Elec. World.

SALES ENGINEER — Technical graduate of good appearance and ability wanted for opening in sales department of manufacturer of small motors and generators. One having testing experience preferred. State age, experience and salary expected. Box 1871, Elec. World.

SUPERINTENDENT WANTED for hydro-electric and steam plant, New York State. Must superintend plant, hustle for new business, direct construction and maintenance of pole line and willing to start on fair salary. Box 1876, Elec. World.

TESTING DEPARTMENT man wanted by the distribution department of a large electric light company in the East; a man who has had at least one year's training in the test department of the Westinghouse Electric or General Electric companies. Salary $90 per month. State age, full record of experience and names of past employers. Box 1865, Elec. World.

YOUNG MAN WANTED as assistant in office of motor manufacturer; to be experienced in motor applications and capable of handling correspondence regarding them. Give full particulars about past experience, age and salary expected. Box 1905, Elec. World.

## AGENTS AND SALESMEN

### Electrical Salesman

High-grade electrical supply and specialty salesman will be open, January 1, 1914, for position. Credentials of highest character as to ability and character. Box 1891, Elec. World.

### New York Agency Wanted

New York Agency with competent selling force would consider another good article electrical or mechanical to handle in New York or vicinity. Box 1855, Elec. World.

### Foreign Agency Wanted

Copper Wires, etc.—English engineer at present manager of established Electrical Agency business in London, desires to represent a good firm manufacturing Copper and Brass Wires, etc., or would consider any other good electrical agency. Write 1078, Sells Advertising Offices, Fleet St., London, England.

## AGENTS AND SALESMEN

### Foreign Agency Wanted

Spanish speaking salesman, an American, age 30, University education, will correspond with any firm relative to foreign agency or handling foreign correspondence. Box 1878, Elec. World.

### Agency Wanted

For mechanical an ,delectric apparatus, Philadelphia and Eastern Pennsylvania. Address Box 1888, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

### Agency Wanted

G. M. Cox & Co., 1156 Monadnock Bldg., Chicago, Illinois, manufacturers' agents, can give productive sales representation to a manufacturer of electrical specialties for interior construction work. Write and send catalogue.

## EMPLOYMENT AGENCIES

SUPERINTENDENT, experienced operation interurban service, 30 miles, 12 passenger cars, heavy grades, Central States, salary, $2500-$3000. Master mechanic, experienced motor repair, power plant repairs, operation of power plant, hoisting engines, etc., location, Mississippi; salary, $150. Gas plant foreman, location, Okla.; salary, $900. Road master, electric city and suburban line, 8 miles track, $1300. Several apprentice shop men, large Eastern railway, $40. Five hydro-electric plant design engineers, street railway power plants, must be experienced, general electric equipment, $125-$150. Electricians, armature winders, for large New York, Pennsylvania and Ohio industrial works, $75 to $150. Municipal lighting superintendent, Kentucky, $100. Three instructors, $900-$1409. American Service Company, Pittsburgh, Pa.

ENGINEERS, Superintendents, Foremen, Designers and Draftsmen, Sales Engineers, etc., will find it to their advantage to investigate our methods of procedure. We deal in "positive" openings and you do not pay for a service which is problematic. We are giving every one who registers with us the benefits of 21 years' experience, and there is no better means of keeping in touch with positive, definite and legitimate openings than through this office. During January and February of every year we are short of men for the "positive" openings we get. Indications are that business will be exceptionally good during the next several months. In order to be supplied for the demand upon us, we will make special inducements to all applicants for positions who write us before January 3. To receive these inducements applications must be addressed to Department "C," and state fully previous experience. All information received strictly confidential. The Engineering Agency, Inc.—20th year—Chicago, Ills.

## EDUCATIONAL

METERMEN WANTED to enroll for complete practical course on "Electrical Measuring Instruments and Meters." Endorsed by leading electrical men. Write for booklet. "Instruments and Meters," giving full information. Fort Wayne Correspondence School, No. 913, Shoaff Bldg., Fort Wayne, Ind.

RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.—Courses in Civil, Mechanical, Electrical and Chemical Engineering and General Science leading to the degree of Civil Engineer (C.E.), Mechanical Engineer (M.E.), Electrical Engineer( E.E.), Chemical Engineer (Ch.E.), and Bachelor of Science (B.S.). Also special courses. Splendidly equipped new engineering laboratories. Send for catalogues to the Registrar.

*Published, November,* 1913

*CHRISTIE—*

# Electrical Engineering

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**By CLARENCE V. CHRISTIE, M.A., B.Sc.**

Assistant Professor of Electrical Engineering, McGill University, Montreal, Canada.

417 *pages,* 6 *x* 9. *Nearly* 400 *illustrations*
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The fundamentals of electrical engineering, designed primarily for those who have a knowledge of elementary physics and some training in mathematics. It offers a clear conception of the theory and characteristics of electrical machinery.

The book has already excited an unusual amount of favorable comment from teachers throughout the country.

It fits in with and supplements "Electrical Machine Design," prepared by the author's associate, A. M. Gray, and published by us this year.

**CONTENTS**

I. Electrostatics. II. Magnetism and Electromagnetics. III. Electric Circuits. IV. Direct-Current Machinery. V. Synchronous Machinery, Alternators and Synchronous Motors. VI. Transformers. VII. Induction Motor. VIII. Alternating-Current Commutator Motors. IX. Converters. X. Transmission Line.

*COHEN—* (*Published Oct.,* 1913)

**Formulæ and Tables for the Calculation of**

# Alternating Current Problems

By LOUIS COHEN, formerly Member of Scientific Staff of Bureau of Standards.

281 *pages,* 6 *x* 9, $3.00 (12/6) *net, postpaid.*

It brings together in compact form all of the important formulæ which are necessary and helpful in the solution of alternating current problems.

**CONTENTS**

I. Resistance and Eddy Current Losses in Metallic Conductors. II. Inductance. III. Capacity. IV. Alternating Current Circuits. V. Transient Phenomena. VI. Distributed Inductance and Capacity. VII. Mathematical Formulæ.

*NORTHRUP—*

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By EDWIN F. NORTHRUP, Ph.D.

389 *pages,* 6 *x* 9, *illus.,* $4.00 (17*s*) *net, postpaid.*

Dr. Northrup prepared this book with a view to its usefulness in commercial measurements and tests. He offers much valuable material for the engineer in practice.

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It describes many methods, gives some sample measurements, and details of typical instruments. In every case practical results rather than highly theoretical possibilities are given.

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*Gray—*

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I. An immense amount of "reason why" information.

II. The use of computations rather than empirical data.

III. The relatively rational order of procedure.

It covers the theory, design, construction, operation and specification of electrical machinery.

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### Design of Polyphase Generators and Motors

By H. M. HOBART, Consulting Engineer, General Electric Co. 260 *pages,* 6 *x* 9, *illustrated,* $3.00 (12/6).

Presents calculations together with fundamental outlines, in a clear, authoritative discussion.

It takes up immediately the calculations for a simple design with a given rating as regards output, speed, periodicity and pressure. It is exceptionally well illustrated.

*Blondel—*

### Synchronous Motors and Converters

By ANDRE E. BLONDEL. Translated from the French by C. O. Mailloux, with additional chapters by Prof. Comfort A. Adams, Harvard University. 300 *pages,* 6 *x* 9, *illustrated,* $3.00 (12/6).

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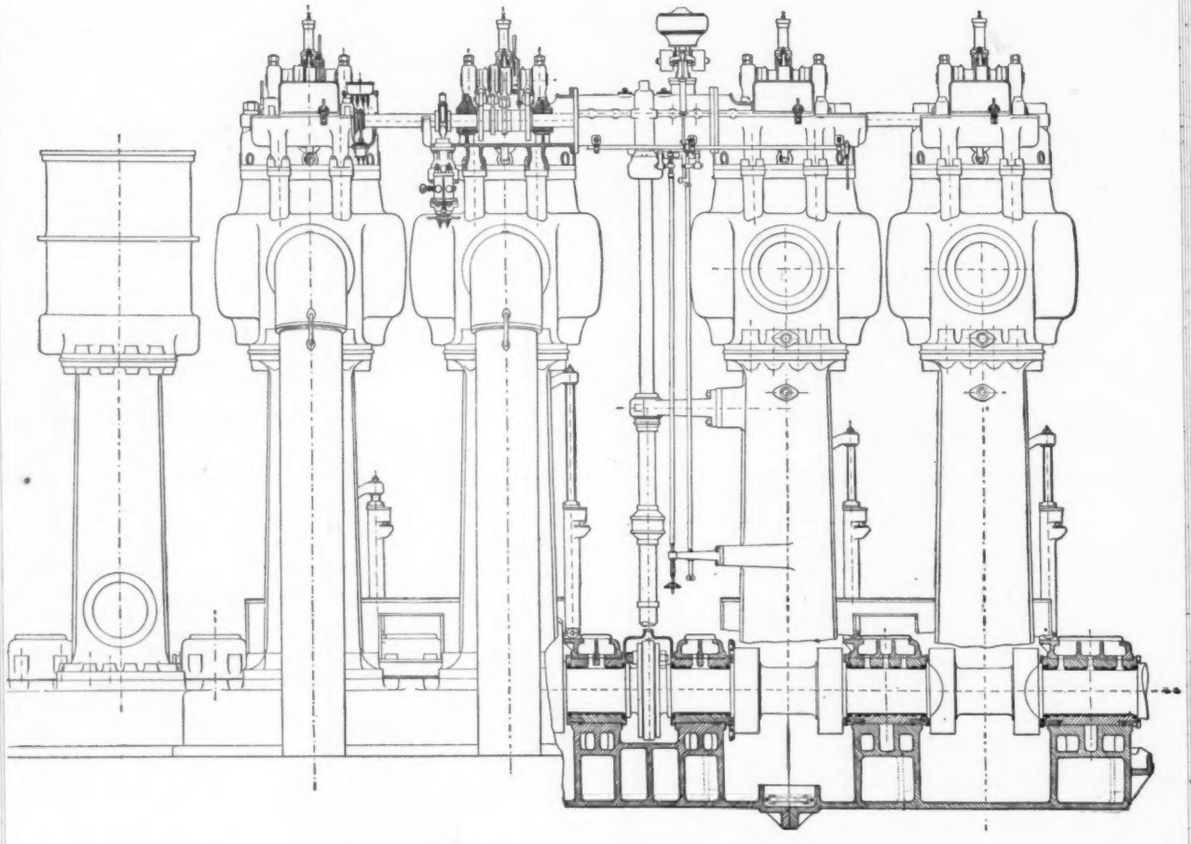

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# READY-REFERENCE INDEX

## to products manufactured by advertisers in this issue of Electrical World

Nearly 300 different products are here listed.

The Alphabetical Index (see fourth page following) gives the page number of each advertisement.

As far as possible advertisements are so arranged that those relating to the same kind of goods or apparatus will be found together.

This ready-reference index is up to date, changes being made each week.

If you don't find listed in these pages any electrical product of which you desire the name of the maker, write or wire Electrical World, and we will promptly furnish the information.

**Air Compressors.**
Allis-Chalmers Mfg. Co.
Murray Iron Works.

**Aluminum.**
Aluminum Co. of America.

**Ammeters, Voltmeters.**
(See Instruments, Electrical.)

**Anchors, Guy.**
Barnes & Kobert Mfg. Co.
Matthews & Bro., W. N.
Universal Cable Grip Co.

**Annunciators.**
Ostrander & Co., W. R.
Western Electric Co.

**Asbestos, Wood.**
Johns-Manville Co., H. W.

**Associations, Vehicle.**
Electric Vehicle Assn. of Am.

**Automobiles.**
Baker Motor Vehicle Co.

**Ball Bearings.**
Hess-Bright Mfg. Co.
Norma Co. of America.

**Batteries, Dry Cell.**
Johns-Manville Co., H. W.
Manhattan Elec'l Supply Co.
National Carbon Co.
Nungesser Carbon & Bat. Co.

**Batteries, Storage.**
Edison Storage Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
National Carbon Co.
National Metal & Rubber Co.
Willard Storage Battery Co.

**Battery Connections.**
Fahnestock Electric Co.

**Bells.**
Manhattan Elec'l Supply Co.
Ostrander & Co., W. R.
Western Electric Co.

**Belting.**
Chicago Rawhide Co.

**Binding Posts.**
Fahnestock Electric Co.

**Boilers.**
Babcock & Wilcox Co.
Murray Iron Works.

**Bolts, Expansion.**
Hubbard & Co.

**Books, Technical.**
American School of Correspondence.
McGraw-Hill Book Co., Inc.

**Boosters.**
Crocker-Wheeler Co.
Ridgway Dynamo & Eng. Co.
Triumph Electric Co.
Westinghouse Elec. & Mfg. Co.

**Boxes, Fire Alarm.**
Siemens & Halske.

**Boxes, Fuse.**
Detroit Fuse & Mfg. Co.
Johns-Manville Co., H. W.
Matthews & Bro., W. N.

**Boxes, Junction and Outlet.**
Chicago Fuse Mfg. Co.
D. & W. Fuse Co.
Johns-Manville Co., H. W.

**Boxes, Meter and Service.**
Johns-Manville Co., H. W.

**Brackets and Pins, Metal.**
Hubbard & Co.
Pittsburgh Transformer Co.

**Brushes, Dynamo.**
Holmes Fibre-Graphite Mfg. Co.
Jeandron, W. J.
Le Valley Vitæ Carbon B. Co.
Morgan Crucible Co., Ltd.
National Carbon Co.
Speer Carbon Co.
Stackpole Carbon Co.

**Buildings, Steel.**
Blaw Steel Cons. Co.
Riter-Conley Mfg. Co.

**Bushings.**
Condit Electrical Mfg. Co.

**Cable, Electric.**
Siemens & Halske.

**Cable End Bells.**
Electrical Engrs. Equip. Co.

**Cable Grips.**
Universal Cable Grip Co.

**Cable Joints.**
G. & W. Electric Specialty Co.

**Cable Junction Boxes.**
Standard Underg'd Cable Co.

**Cable Racks.**
Cope, T. J.

**Cable Rollers.**
Matthews & Bro., W. N.

**Cable Splicing Joints.**
Matthews & Bro., W. N.

**Cabling Machinery.**
American Ins. Machy. Co.
New England Butt Co.
Torrington Mfg. Co.

**Car Heaters, Electric.**
Simplex Electric Heating Co.

**Carbons.**
Cary Co., Inc., Edw. L.
Graphite Metalizing Corpn.
Hirschberg Co., H. M.
Koerting & Mathieson Co. Inc.
National Carbon Co.
Reisinger, Hugo.
Stackpole Carbon Co.

**Castings.**
Pittsburgh Valve, F. & C. Co.
Triumph Electric Co.

**Chains, Driving.**
Morse Chain Co.

**Chandeliers.**
Beardslee Chandelier Mfg. Co.
Benjamin Elec. Mfg. Co.
Goodwin & Kintz.

**Circuit Breakers.**
Bowie Switch Co.
Condit Electrical Mfg. Co.
Cutter Co.
General Electric Co.
Machado & Roller.
Roller-Smith Co.
Sangamo Elec. Co.
Sundh Electric Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

**Clamps, Ground Connection.**
Belden Mfg. Co.

**Clamps, Guy.**
Barnes & Kobert Mfg. Co.
Matthews & Bro., W. N.
Universal Cable Grip Co.

**Cleaners, Electric Suction.**
Geier Co., P. A.

**Cleats.**
Blake Signal & Mfg. Co.
Colonial Sign & Ins. Co.
Imperial Porcelain Co.
National Metal M. Co.
Pass & Semour, Inc.
Sears, Henry D.

**Climbers.**
Cincinnati Tool Co.
Klein & Sons, Mathias.

**Clips, Cable.**
Matthews & Bro., W. N.

**Clusters.**
Benjamin Electric Mfg. Co.
Federal Sign System (Electric).
Hubbell, Inc., Harvey.
Luminous Unit Co.

**Coils, Armature Field.**
D. & W. Fuse Co.
Independent Lamp & Wire Co.

**Coils, Chokes.**
Railway & Industrial Eng. Co.

**Coils, Induction.**
Ostrander & Co., W. R.
Splitdorf Elec'l Co.
Western Elec. Co.

**Coils, Spark.**
Western Electric Co.

**Commutator Truers.**
Jordan Bros.

**Compounds, Boiler.**
Dearborn Chemical Co.

**Compounds, Commutator.**
McLellan Co., K.

**Condensers.**
Allis-Chalmers Mfg. Co.
Westinghouse Machine Co.
Wheeler Mfg. Co., C. H.
Worthington, Henry R.

**Conduit Bends.**
Fibre Conduit Co.

**Conduit Fittings.**
Central Electric Co.
Pass & Seymour, Inc.

**Conduit Rods.**
Cope, T. J.

**Conduits, Interior.**
Amer. Conduit Mfg. Co.
National Metal Moulding Co.
Tubular Woven Fabric Co.

**Conduits, Underground.**
American Conduit Co.
American Vitrified Conduit Co.
Fibre Conduit Co.
Gest, G. M.
Johns-Manville Co., H. W.
Michigan Pine Co.
National Conduit & Cable Co.

**Controllers.**
Allen-Bradley Co.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Appliance Co.
Electric Controller & Mfg. Co.
General Electric Co.
Monitor Controller Co.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

**Conveying Machinery.**
(Coal, Ashes, Etc.)
American Bridge Co.
Green Engineering Co.
Morse Chain Co.
Northern Eng. Works.

**Cooling Towers.**
Wheeler Mfg. Co., C. H.

**Cord Adjusters.**
American Vul. Fibre Co.

**Cord, Arc Lamps.**
Samson Cordage Works.

**Cord, Flexible.**
American Electrical Works.
Belden Mfg Co.

**Cord, Trolley.**
Samson Cordage Works.

**Counting Scales.**
National Scale Co.

**Couplings, Flexible.**
Bruce-Macbeth Engine Co.

**Crane Motors.**
Crocker-Wheeler Co.
Triumph Electric Works.
Westinghouse Elec. & Mfg. Co.

**Cranes, Traveling.**
American Bridge Co.
Maris Bros.
Northern Engineering Works.

**Cross-Arms.**
American Bridge Co.
Riter-Conley Co.
Western Elec. Co.

**Crossing Protective Clamps**
Siemens & Halske.

**Cutouts.**
D. & W. Fuse Co.
G. & W. Electric Specialty Co.
Sears, Henry D.

**Cutouts (Automatic).**
Thompson Elec. Co.

**Dies.**
Col's Die, Tool & Machine Co.

**Drills.**
Cincinnati Elec. Co.

**Drills, Brick.**
Hubbard & Co.

**Drills, Electric.**
Siemens & Halske.
U. S. Elec'l Tool Co.

**Drills, Portable.**
Stow Mfg. Co.

**Dynamos and Motors.**
Allis-Chalmers Mfg. Co.
Burke Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Electro-Dynamic Co.
Emerson Electric Mfg. Co.
General Electric Co.
Gregory Electric Co.
Kimble Electric Co.
Lincoln Electric Co.
Peerless Electric Co.
Reliance Elec. & Eng. Co.
Richmond Elec. Works.
Ridgway Dynamo & Eng. Co.
Robbins & Myers Co.
Siemens & Halske.
Stow Mfg. Co.
Strelinger Co., Chas. A.
Triumph Electric Co.
Wagner Electric Co.
Westinghouse Elec. & Mfg. Co.

**Electromagnets.**
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.
Sundh Electric Co.

**Electroplating.**
Luminous Unit Co.

**Engineers, Consulting.**
(See Directory of Engineers.)

**Engineers, Contracting.**
(See Directory of Engineers.)

**Engines, Gas and Gasoline.**
Allis-Chalmers Mfg. Co.
Bruce-Macbeth Engine Co.
Carlisle & Finch Co.
Otto Gas Engine Wks.
Strelinger Co., Chas. A.
Westinghouse Mach. Co.

**Engines, Oil.**
Hoynie, W. R.
Lyons Atlas Co.
McIntosh & Seymour Co.
Remington Oil Engine Co.

**Engines, Steam.**
Allis-Chalmers Mfg. Co.
McIntosh & Seymour Co.
Murray Iron Works.
Ridgway Dynamo & Eng. Co.
Westinghouse Mach. Co.

**Experimental Apparatus.**
Biddle, James G.
Esterline Co.
Machado & Roller.

**Fan Motors.**
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
General Electric Co.
Peerless Electric Co.
Robbins & Myers Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Fans (Exhaust and Ventilating)**
Crocker-Wheeler Co.
Emerson Elec. Mfg. Co.
Kimble Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Fibre (See Insulating Material).**
American Vul. Fibre Co.
Continental Fibre Co.
Fibre Conduit Co.
Johns-Manville Co., H. W.

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## to products manufactured by advertisers in this issue of Electrical World

**Field Coil Pads.**
Mass. Chemical Co.
Walpole Tire & Rubber Co.

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Coal & Iron National Bank.
Electric Bond & Share Co.

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Pyrene Mfg. Co.

**Fixtures, Electric and Gas.**
Beardslee Chandelier Mfg. Co.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co.
Federal Sign System (Electric).
Goodwin & Kintz Co.
Johns-Manville Co., H. W.
Luminous Unit Co.

**Flashers.**
Campbell Electric Co.

**Friction Tape and Cloths.**
Johns-Manville Co., H. W.
Massachusetts Chem. Co.
Walpole Tire & Rubber Co.

**Furnaces, Electric**
Siemens & Halske.

**Fuses.**
Bowie Switch Co.
Chicago Fuse Mfg. Co.
Conduit Elec. Mfg. Co.
D. & W. Fuse Co.
Daum Co., A. F.
Delta Star Elec. Co.
Detroit Fuse & Mfg. Co.
Johns-Manville Co., H. W.
Multi-Refillable Fuse Co.
Railway & Industrial Eng. Co.
Sears, Henry D.

**Fuse Boxes.**
**(See Boxes, Fuse.)**

**Gauges, Recording.**
Bristol Co.
Industrial Instrument Co.

**Gauges, Water Column.**
Jenkins Bros.

**Gears.**
Chicago Rawhide Co.
New Process Gear Corp.

**Glass.**
Lippincott Glass Co.

**Globes, Shades, Etc.**
Faries Mfg. Co.
Lippincott Glass Co.

**Graphite.**
Dixon Crucible Co., Joseph.

**Grinders, Electrically Driven.**
U. S. Elec'l Tool Co.

**Grounds, Etc.**
Paragon Electric Co.

**Guards, Inc., Lamps.**
Hubbell, Inc., Harvey.
Matthews & Bro., W. N.

**Hair Dryers.**
Geier Co., P. A.
Shelton Elec. Co.

**Hangers, Arc Lamp.**
Thompson Elec. Co.

**Hangers, Cable.**
Condit Electric Mfg. Co.
Matthews & Bro., W. N.
Stand. Underground Cable Co.

**Head Gates.**
American Bridge Co.

**Heaters, Feed Water.**
Harrison Safety Boiler Works.
Wheeler Mfg. Co., C. H.

**Heating Devices, Electric.**
American Ironing Mach. Co.
Cutler-Hammer Mfg. Co.
Dubilier Elec. Co.
General Electric Co.
Hughes Elec. Heating Co.
Simplex Electric Heating Co.
Westinghouse Elec. & Mfg. Co.

**Heating, Steam.**
American District Steam Co.

**Hoists, Electrical and Steam.**
Allis-Chalmers Mfg. Co.
Maris Bros.
Northern Engineering Works.
Siemens & Halske.

**Ice Machines.**
Carbondale Machine Co.
Johns-Manville Co., H. W.
United Ice Improvement Co.

**Ignitors, Gas Engine.**
Carlisle & Finch Co.

**Indicator, Speed.**
Biddle, James G.
Machado & Roller.

**Injectors.**
Jenkins Bros.

**Instruments, Electrical.**
*Graphic.*
Biddle, James G.
Bristol Co.
Esterline Co.
General Electric Co.
Keystone Electrical Inst. Co.
Sangamo Elec. Co.
Siemens & Halske.
Westinghouse Elec. & Mfg. Co.

**Indicating.**
Eldredge Elec. Mfg. Co.
General Electric Co.
Hoyt Elec'l Instr. Co.
Kermel Apparatus Co.
Keystone Electrical Inst. Co.
Machado & Roller.
Roller-Smith Co.
Siemens & Halske.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instr. Co.

*Integrating.*
Biddle, James G.
Columbia Meter Co.
Duncan Elec. Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Sangamo Elec. Co.
Siemens & Halske.
Westinghouse Elec. & Mfg. Co.

*Scientific and Testing.*
Biddle, James G.
Esterline Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.
Matthews & Bro., W. N.
Siemens & Halske.

**Insulating Cement.**
Massachusetts Chem. Co.
Walpole Tire & Rubber Co.

**Insulating Machinery.**
American Ins. Mach'y Co.
New England Butt Co.

**Insulating Material.**
*China and Porcelain.*
Colonial Sign and Ins. Co.
Imperial Porcelain Works.
Locke Insulator Mfg. Co.
Pittsburgh H. V. Ins. Co.
Thomas & Sons Co., R.

*Cloth.*
Anchor Webbing Co.

*Compounds, Paints and Varnishes.*
Electric Cable Co.
General Bakelite Co.
Massachusetts Chem. Co.
Mitchell-Rand Mfg. Co.
Nat'l Ins. Co. of Pittsburgh
Standard Varnish Works.
Walpole Tire & Rubber Co.

*Composition. Cloth and Paper.*
Meirowsky Bros.
Siemons Hard Rubber Co.
Walpole Tire & Rubber Co.

*Fibre.*
Continental Fibre Co.
Diamond State Fibre Co.
Electric Service Co.
Johns-Manville Co., H. W.
Massachusetts Chem. Co.

*Lava.*
Steward Mfg. Co., D. M.

*Mica.*
Electric Service Co.
Jaroslaw, D.
Meirowsky Bros.
Mica Co. of Canada.
Munsell & Co., Eugene.

*Tape.*
American Electrical Works.
Anchor Webbing Co.
Johns-Manville Co., H. W.
Massachusetts Chem. Co.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.
New York Insulated Wire Co.
Okonite Company.
Stand. Underground Cable Co.
Walpole Tire & Rubber Co.

**Insulators.**
*China, Porcelain and Composition.*
Anderson Mfg. Co., A. & J. M.
Colonial Sign & Ins. Co.
General Electric Co.
General Insulate Co.
Imperial Porcelain Works.
Locke Insulator Mfg. Co.
Pittsburgh High Volt Ins. Co.
Sears, Henry D.
Thomas & Sons Co., R.

*Glass.*
Brookfield Glass Co.
Hemingray Glass Co.
High Tension Elec'l Spec. Co.
Locke Insulator Mfg. Co.

*Wood.*
Barnes & Kobert Mfg. Co.

**Ironing Machines, Electric.**
American Ironing Mach. Co.

**Jig and Fixture Work.**
Col's Die, Tool & Machine Co.

**Lamps, Arc.**
Electro Development Co.
General Electric Co.
Hirschberg Co., H. M.
Koerting & Mathiesen Co., Inc.
Reisinger, Hugo.
Siemens & Halske.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Lamps, Flaming Arc.**
General Electric Co.
Hirschberg Co., H. M.
Koerting & Mathiesen Co., Inc.
Reisinger, Hugo.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Lamp Guards.**
McGill Mfg. Co.
Hubbell Inc., Harvey.

**Lamps, Incandescent.**
Ætna Electric Co.
Buckeye Elec. Works.
Cons. Elec. Lamp Co.
Deuth & Co.
General Electric Co.
Independent Lamp & Wire Co.
National Lamp Works.
Siemens & Halske.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Westinghouse Lamp Co.

**Lamp Locks.**
Pass & Seymour, Inc.

**Lamps, Miniature.**
Beacon Min. Lamp Co.
Cary Co., Inc., Edw. L.
General Electric Co.

**Lamps, Portable.**
Luminous Unit Co.

**Lamps, Replacers.**
Matthews & Bro., W. N.

**Lava.**
**(See Insulating Material, Lava.)**

**Lighting Companies.**
Commonwealth Edison Co.

**Lightning Arresters.**
Delta Star Elec. Co.
General Electric Co.
Railway & Industrial Eng. Co.
Westinghouse Elec. & Mfg. Co.

**Line Material.**
Anderson Mfg. Co., A. & J. M.
Archbold Brady Co.
Electrical Engrs. E. Co.
G. & W. Elec. Specialty Co.
Johns-Manville Co., H. W.
Pacific Elec. & Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Linemen's Tools.**
**(See Tools, Linemen.)**

**Lubricants.**
Dearborn Chemical Co.
Dixon Crucible Co., Joseph.
Kellogg Co., E. H.

**Magnet Wire.**
American Brass Co.
Am. Enam. Magnet Wire Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
D. & W. Fuse Co.
Hazard Mfg. Co.
Independent Lamp & Wire Co.
Massachusetts E. & Mfg. Co.
Standard Underg'd Cable Co.
Western Electric Co.

**Magnets.**
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Leslie & Co., A. C.

**Magnets, Lifting.**
Cutler-Hammer Mfg. Co.

**Magnetos.**
Splitdorf Electrical Co.

**Magnet Wire.**
Hazard Mfg. Co.

**Mechanical Stokers.**
Westinghouse Machine Co.

**Medical Apparatus.**
Manhattan Elec'l Supply Co
Pignolet, L. M.
Siemens & Halske.

**Metal Stampings.**
Natl. Metal Stamping Co.

**Meter Seals.**
Palmer Electric & Mfg. Co.

**Meter Testers.**
States Company.

**Mica.**
Electric Service Co.
Geier Co., P. A.
Jaroslaw, D.
Mierowsky Bros.
Mica Co. of Canada, Ltd.

**Mining Machinery.**
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
General Electric Co.

**Model Makers.**
Esterline Co.

**Motors.**
**(See Dynamos and Motors.)**

**Nippers and Pliers.**
Cincinnati Tool Co.
Klein & Son, Mathias.
Smith & Hemenway.

**Novelties, Electric.**
Anderson Lt. & Spec. Co.
Carlisle & Finch Co.
Cary & Co., Inc., Edw. E.

**Oil, Cylinder.**
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**Ozonizers.**
General Electric Co.

**Packing.**
Jenkins Bros.

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Baseler & Heineken.
Trumbull Electric Mfg. Co.
Walker Elec. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Miller, Luther L.
Institute of Indus. Research.

**Penstock.**
Portland Wood Pipe Co.

**Photometer Standards.**
Elect'l Testing Laboratories.

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Chicago Rawhide Co.
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**Pipe.**
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**Platinum.**
American Platinum Works.
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Roessler & Hasslacher C. Co.

**Plugs.**
Condit Electrical Mfg. Co.
Hubbell, Inc., Harvey.
National Metal & Mould. Co.
Paiste Co., H. T.
Pass & Seymour, Inc.
Sears, Henry D.

**Pole Erectors.**
American Bridge Co.
Matthews & Bro., W. N.

**Pole Line Hardware.**
Hubbard Co.

**Poles.**
Naugle Pole & Tie Co.
Sand Point Lumber & Pole Co.
Western Lumber & Pole Co.

**Poles, Arc Lamp.**
Electric Railway Equip. Co.
Flour City Orn. Iron Works.
Mott Iron Works, J. L.
Union Metal Mfg. Co.

**Poles, Brackets, Pins, Etc.**
Carney Co., B. J.
Naugle Pole & Tie Co.
Sand Point Lumber & Pole Co.
Western Electric Co.
Western Lumber & Pole Co.

**Poles, Steel.**
American Bridge Co.
Archbold, Brady Co.
Blaw Steel Cons. Co.
Franklin Steel Co.
Riter-Conley Co.
Transmission Eng'g Co.

**Porcelain. (See Insulating Material, China and Porcelain.)**

**Potentiometers.**
Biddle, James G.
Leeds & Northrup Co.

**Potheads.**
Colonial Sign & Ins. Co.
Elec'l Engineers Equip. Co.
G & W Electric Specialty Co.

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Morse Chain Co.

**Producers, Gas.**
Westinghouse Machine Co.

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**Protective Devices.**
Metropolitan Eng'g Co.

**Pulleys.**
Rockwood Mfg. Co.

**Pumps, Centrifugal.**
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**Pumps, Electric.**
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Siemens & Halske.

**Pumps, Oil.**
Ludlow Valve Mfg. Co.

**Pumps, Steam.**
Allis-Chalmers Mfg. Co.
Wheeler Mfg. Co., C. H.
Worthington, Henry R.

**Pumps, Vacuum.**
Wheeler Mfg. Co., C. H.

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**Pyrometers.**
Keystone Electrical Inst. Co.

**Rail Bonds.**
Condit Electrical Mfg. Co.
Roebling's Sons Co., J. A.

**Railways, Miniature.**
Carlisle & Finch Co.

**Receptacles. (See Sockets.)**

**Rectifiers.**
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Reflectors.**
Goodwin & Kintz Co.
Johns-Manville Co., H. W.
Luminous Unit Co.

**Refrigerating Machines.**
Carbondale Machine Co.
Johns-Manville Co., H. W.
United Ice Improvement Co.

**Repairing.**
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**Resistance Units.**
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Simplex Electric Heating Co.
Ward-Leonard Electric Co.
Wirt Company.

**Resistance Wire.**
(See Wires, Resistance.)

**Rheostats.**
Biddle, James G.
Campbell Electric Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Monitor Controller Co.
Simplex Electric Heating Co.
Sundh Electric Co.
Ward-Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

**Rosettes.**
Hart Mfg. Co.
National Metal Molding Co.
Paiste Co., H. T.
Pass & Seymour.
Sears, Henry D.
Trumbull Electric Mfg. Co.

**Sal Ammoniac.**
Roessler & Hasslacher C. Co.

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National Scale Co.

**Scales, Weighing.**
National Scale Co.

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Harrison Safety Boiler Works.

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Hubbell, Inc., Harvey.

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Amer. Sheet & Tin Plate Co.

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**Sign Letters, Electric.**
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Federal Sign System (Electric).

**Signs, Electric.**
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**Signs, Miniature.**
Deschere, Harvey.

**Sleeving, Braided.**
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**Sockets & Receptacles**
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Cutler-Hammer Mfg. Co.
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Johns-Manville Co., H. W.
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Sears, Henry D.

**Sockets, Turndown.**
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Condit Electrical Mfg. Co.
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**Steel.**
Leslie & Co., A. C.

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Stanley & Patterson.
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**Switchboard Mats.**
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**Switchboard Supplies.**
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Machado & Roller.
West. Elec. & Mfg. Co.

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Siemens & Halske.
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Walker Elec. Co.
Western Elec. Co.
West. Elec. & Mfg. Co.

**Switches.**
Bowie Switch Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
High Tension Elec'l Spec. Co.
Pacific Elec. Mfg. Co.
Railway & Industrial Eng. Co.
Sundh Electric Co.
West. Elec. & Mfg. Co.

**Switches, Fuse.**
Matthews & Bro., W. N.

**Switches, Knife.**
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Detroit Fuse & Mfg. Co.
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West. Elec. & Mfg. Co.

**Switches, Oil.**
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General Electric Co.
High Tension Elec. Spec. Co.
West. Elec. & Mfg. Co.

**Switches, Pole Top.**
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K .P. F. Electric Co.

**Switches, Snap & Push Button.**
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General Electric Co.
Hart Mfg. Co.
Metropolitan Elec. Mfg. Co.
Pass & Seymour.

**Switches, Time.**
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Campbell Electric Co.
Hartford Time Switch Co.

**Tachometers.**
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Electric Tachometer Co
Industrial Instrument Co.
Keystone Elec'l Inst. Co.
Machado & Roller.

**Taps & Dies.**
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Siemens & Halske.
Western Electric Co.

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Eureka Supply Co.

**Terminals, Cable.**
Standard Underg'd Cable Co.

**Testing Apparatus.**
American Transformer Co.
Biddle, James G.
Esterline Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.
Machado & Roller.
Matthews & Bro., W. N.
Siemens & Halske.

**Testing, Electrical.**
Electrical Testing Laboratories.
Wire Inspection Bureau.

**Testing Laboratories.**
Electrical Testing Laboratories.

**Theatre Dimmers.**
Cutler-Hammer Mfg. Co.
General Electric Co.
Simplex Elec. Heating Co.
Ward-Leonard Electric Co.

**Thermometers.**
Industrial Instrument Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.

**Tools, Construction.**
Klein & Sons, Mathias.

**Tools, Linemen's.**
Cincinnati Tool Co.
Klein & Sons, Mathias.
Smith & Heminway.

**Towers, Transmission.**
American Bridge Co.
Archbold-Brady Co.
Blaw Steel Cons. Co.
Riter-Conley Co.
Transmission Eng'g Co.

**Transformers.**
Allis-Chalmers Mfg. Co.
American Transformer Co.
Campbell Electric Co.
Crocker-Wheeler Co.
Duncan Elec. Mfg. Co.
Enterprise Elec. Co.
Esterline Co.
General Electric Co.
Moloney Electric Co.
Packard Electric Co.
Siemens & Halske.
Triumph Elec. Co.
Wagner Elec. Mfg. Co.
West. Elec. & Mfg. Co.

**Transformers, Bell Ringing.**
West. Elec. & Mfg. Co.

**Turbines, Steam.**
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General Electric Co.
Kerr Turbine Co.
Siemens & Halske.
Western Electric Co.
Westinghouse Machine Co.

**Valve Disks.**
Jenkins Bros.

**Valves.**
Jenkins Bros
Pittsburgh Valve Co
Smith Electric Co.

**Valves, Cylinder Relief.**
Ludlow Valve Mfg. Co.

**Valves, Pump.**
Jenkins Bros.

**Vehicles, Electric.**
Baker Motor Vehicle Co.

**Vibrators.**
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Shelton Elec. Co.

**Washing Machines, Electric.**
Automatic Elec. Washer Co.
Conlon Elec. Washer Co.
Hurley Mach. Co.

**Waterproofing.**
Mitchell-Rand Mfg. Co.

**Water Sterilizers.**
Forbes Company.

**Water Wheels and Turbines.**
Allis-Chalmers Mfg. Co.
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Pelton Water Wheel Co.
Smith Co., S. Morgan.
Trump Mfg. Co.

**Water Wheel Governors.**
Lombard Governor Co.
Ludlow Valve Mfg. Co.
Woodward Governor Co.

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**Winding Machinery.**
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**Wires, Resistance.**
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Boker & Co., Hermann.
Driver-Harris Wire Co.
Murray Wire Co.

**Wires and Cables.**
Acme Wire Co.
Amer. Brass Co.
Amer. Electrical Works.
Amer. Enam. Magnet Wire Co
Amer. Steel & Wire Co.
Atlantic Ins. Wire & Cable Co.
Belden Mfg. Co.
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Bridgeport Brass Co.
D. & W. Fuse Co.
Detroit Ins. Wire Co.
Driver-Harris Wire Co.
Duplex Metals Co.
Electric Cable Co.
General Electric Co.
Goodrich Co., B. F.
Hazard Mfg. Co.
Independent Lamp & Wire Co.
Indiana Rub. & Ins. Wire Co.
Kerite Ins. Wire & Cable Co.
Lowell Ins. Wire Co.
Massachusetts Elec. Mfg. Co.
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National Conduit & Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Company.
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Safety Ins. Wire & Cable Co
Simplex Wire & Cable Co.
Standard Underg. Cable Co.
Western Electric Co.

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**Wood Preserving.**
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**NOTICE TO ADVERTISERS:**

**Printing begins** on Saturday of each week.
**Changes of copy** received up to 10 A. M. Saturday will appear in the issue of the following week, but no proofs can be submitted for OK before publication.
**New Advertisements** (not changes of copy) received up to Monday noon can appear in the issue of that week, but no proofs can be shown.
**If proofs before printing** are required changes of copy and copy for new advertisements must be in our hands two weeks in advance of the date of publication.


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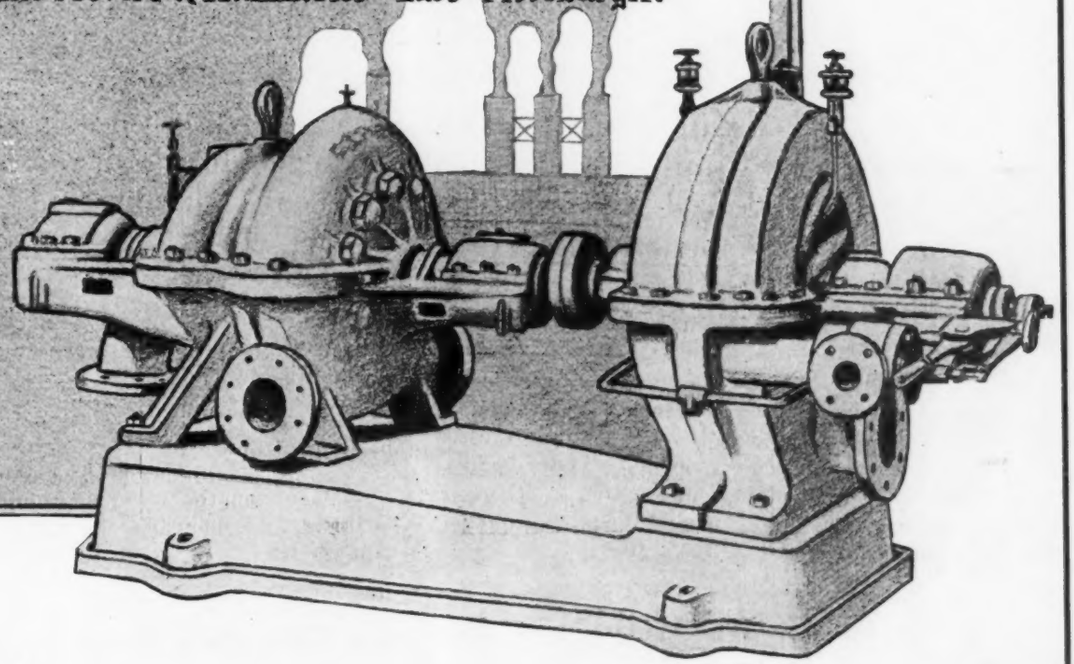

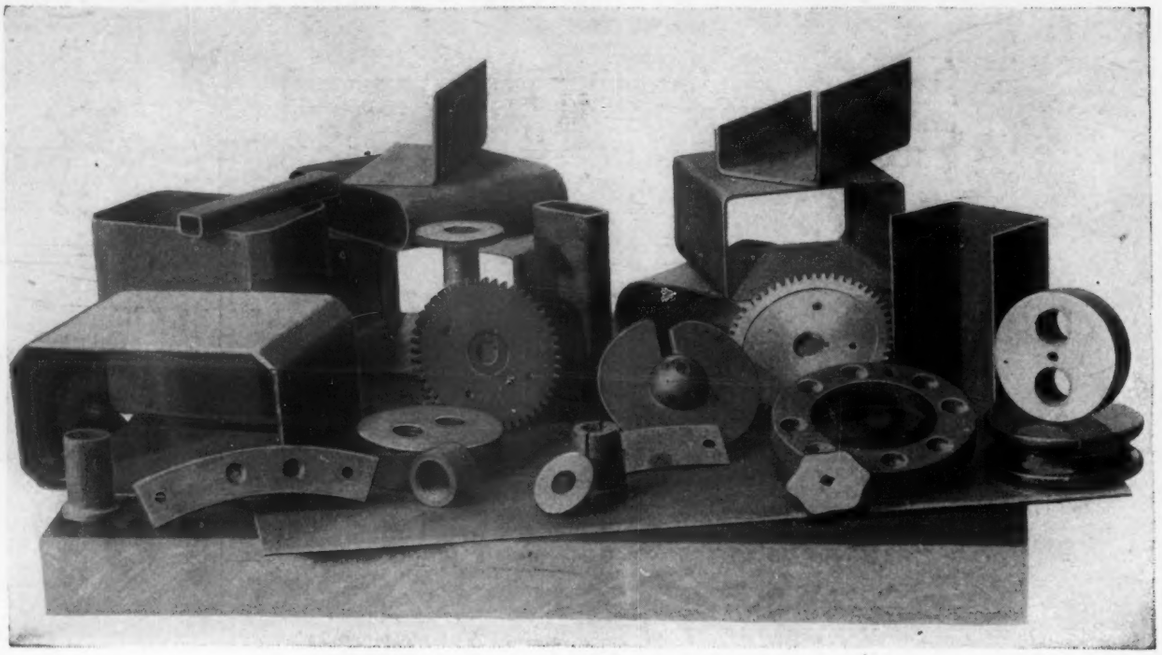

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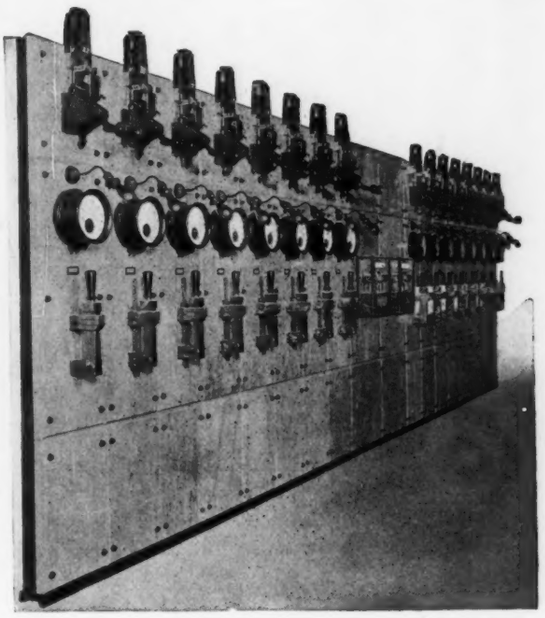

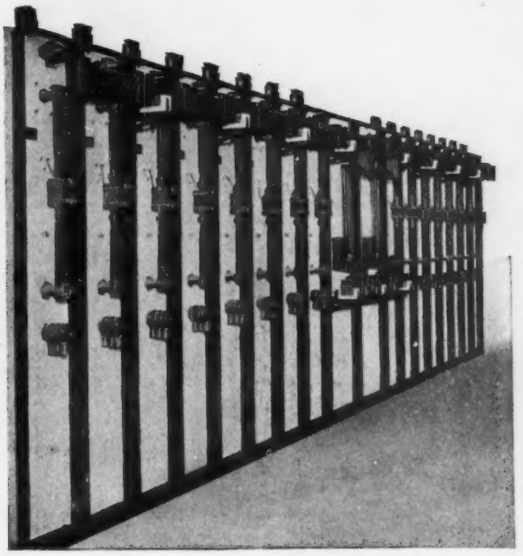

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